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May 10, 1985
File: FC17

Alberta Environment
Waste Management Branch
4th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Attention: Mr. John Slupsky, P.Eng.
Head, Operations and Facilities

Dear Mr. Slupsky:

RE: Waste Disposal Site Study
Final Report

Associated Engineering is pleased to submit fifty (50) copies of our final report entitled Field Investigation of Waste Disposal Sites.

The report evaluates 167 waste disposal sites in Alberta with respect to their potential to adversely affect the environment. The evaluation is summarized from information provided by Alberta Environment, local interviews and site inspections. No direct samplings were undertaken at any of the sites and as a result, evaluation findings are presented in terms of the potential of a site to affect the environment. Only direct sampling can determine the degree and extent of any problems posed at a site. A relative ranking of the 167 waste disposal sites is provided to help direct future investigations.

In closing, we would like to thank Alberta Environment for the opportunity to participate in this challenging project.

Respectfully submitted on behalf of

ASSOCIATED ENGINEERING ALBERTA LIMITED

W. Siemieniuk

W. A. Siemieniuk, B.Sc. M.N.R.M.

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CHAPTER 1
STUDY STRATEGY

INTRODUCTION

For several decades, thousands of tonnes of waste materials have been generated by Alberta households and industries. In 1984 alone, it is estimated that 920,000 tonnes of solid waste and 90,000 tonnes of special waste will require disposal within the Province. Many of these wastes were and are being dumped into unlined pits, thrown in lakes and rivers or accumulated out of sight behind the plant, or in remote areas throughout the Province. The deposition of these waste materials into inadequately sited, designed, and operated active and inactive disposal sites can contribute to the release of contaminants to air, water, and soil. These contaminants have the potential to affect public health, safety, and the environment.

STUDY BACKGROUND

In 1979, at the Canadian Council of Resource and Environment Ministers annual meeting, "the need for a common concerted effort in Canada for the listing and characterization of waste sites, current and abandoned that could conceivably contain waste materials" was identified. The listing and characterization of waste disposal sites was a precondition to identifying potential environmental, health and safety problems. These problems were noted to arise from improper disposal or untimely development on lands, where at some time in the past, there may have been located some waste disposal facility or activity.

In 1981, Alberta Environment, in association with Environment Canada, initiated a study to list and characterize Alberta disposal sites, current and abandoned, that could conceivably contain waste materials. MacLaren Plansearch was commissioned to undertake this inventory of waste disposal sites.

The MacLaren Plansearch study identified 1152 active and inactive disposal sites in Alberta. Of this total, 167 were classified as Priority 1 - - those potentially posing a risk to human health, safety and the environment.

OBJECTIVES

The 167 Priority 1 disposal sites identified by MacLaren Plansearch are the focus of this study. Alberta Environment has commissioned Associated Engineering Alberta Ltd. to confirm the data collected for the 167 Priority 1 sites and to determine the relative ranking of the Priority 1 sites. This ranking would then be used to direct Priority 1 site investigation monitoring and remedial action efforts.

The specific project objectives include:

- To identify information gaps and discrepancies for the 167 Priority 1 disposal sites in Alberta;
- To visit all Priority 1 disposal sites to verify data and fill data gaps;
- To determine the relative rankings of each Priority 1 site so as to focus future detailed site invesigation work;
- To identify and discuss potential pathways of contaminant release from land disposal sites;
- To identify remedial action measures which could be used to reduce or eliminate the imminent or potential impact of a site on human health, safety, and the environment; and
- To identify an implementation plan for government agencies to deal with past and present site problems.

REPORT PRESENTATION

The overall report consists of twelve volumes. This volume, is the written report and addresses:

- Introduction to study;
- Identification and discussion of the problem;
- Synopsis of Alberta sites;
- Approach to site ratings;
- Rating results;
- Remedial Measures, Alternatives and Implementation; and;
- Recommendations of study.

In addition to the report volume, there are 11 site evaluation volumes. These volumes contain the individual site evaluation forms and associated 100 cm^2 aerial photographs for the 167 Priorty 1 disposal sites. The site evaluation volumes are divided according to Alberta Health Unit boundaries and contain the Priority 1 sites within their jurisdiction.

REPORT LIMITATIONS

The sites listed as Priority 1 and studied in this report, are those which were covered in the MacLaren Plansearch Report. The bulk of the sites addressed may be classified as municipal land disposal sites.

No direct sampling of soil, water or waste, was undertaken during this study. Rather, site visits were made in order to confirm file data and to assess which sites have the greatest potential for pollution. Direct sampling only, will determine the degree and type of contamination posed by sites.

CHAPTER 2
CONSEQUENCES OF IMPROPER WASTE DISPOSAL

CONTAMINANT TRANSPORT PATHWAYS

To understand the potential impact of Alberta waste disposal sites on health, safety and the environment, one must first understand how contaminants may be transported away from the site. Waste materials in a disposal site are subject to various transport processes which involve an initial transformation to a more mobile phase, usually by:

- solubilization;
- volatilization; or a
- chemical or biochemical reaction to form soluble or gaseous reaction products.

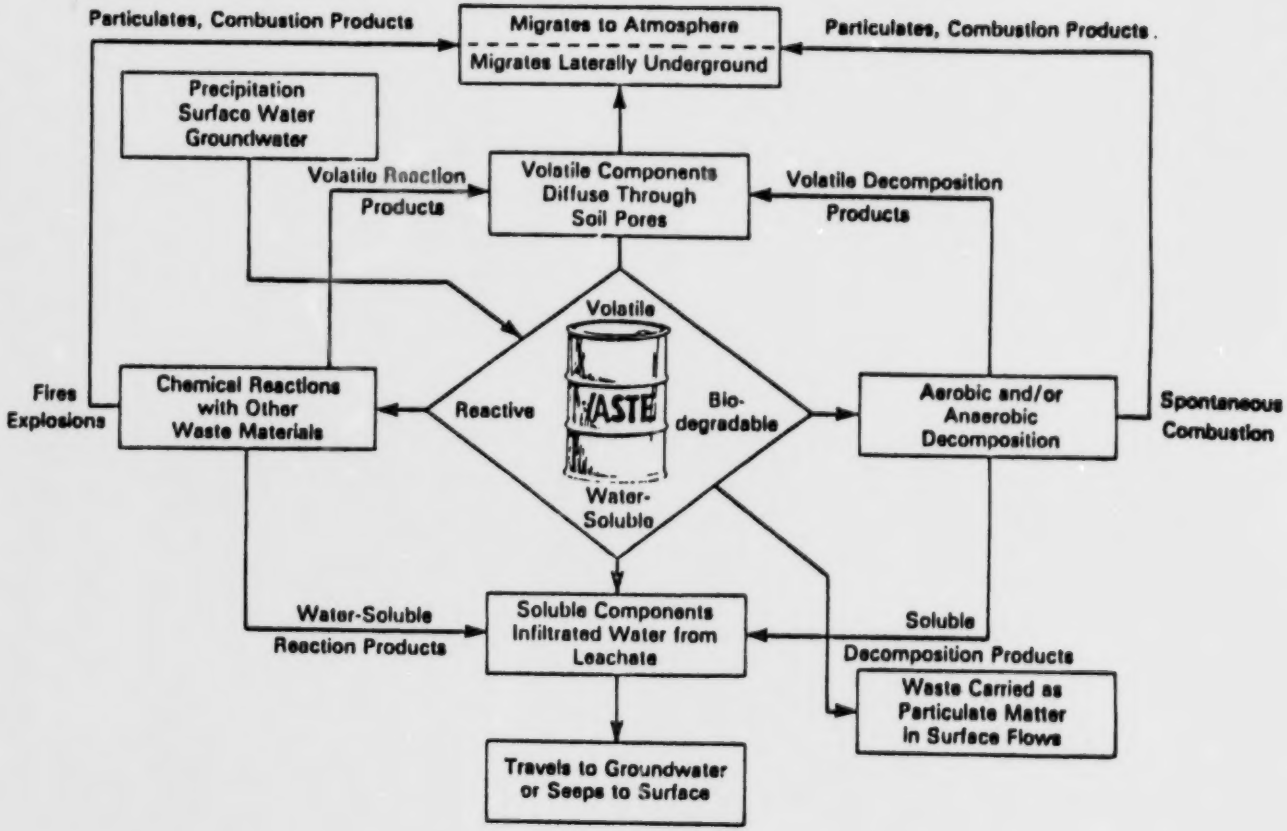
Figure 2-1 presents an overall view of the initial mobilization process involved in contaminant transport at waste disposal sites. This figure shows that volatile and water-soluble components are formed from microbial degradation and chemical reactions with other wastes. Often, the chemical and biochemical reactions can end in explosions and fires that emit particulates, as well as combustion products to the atmosphere. Particulates can also be entrained by surface runoff coming into contact with the waste material. Figure 2-1 illustrates that wastes have the potential to be mobilized in any phase, given the "right" conditions.

When transport mechanisms are available, the waste materials may migrate outside a disposal site and pollute the:

- groundwater;
- surface water;
- air;
- terrestrial; and
- benthic environments.

FIGURE 2-1

TRANSPORT PATHWAYS AT WASTE DISPOSAL SITES



SOURCE: AFTER U.S.E.P.A., 1982

Water plays an especially important role in the mobilization and transport of waste materials from the disposal site to the environment, therefore, the hydrologic cycle must be well understood as it relates to the geology and topography of a disposal site.

Figure 2-2 illustrates the flow of water through and around a waste disposal site and the transport of waste constituents to various environmental sinks. From Figure 2-2, it is apparent that there are many potential hydraulic pathways a contaminant may follow depending on site characteristics. For example, leachate may travel downward vertically to contaminate groundwater, or it may travel laterally and emerge as surface seepage, depending on local soil conditions and characteristics. The hydraulic relationship between groundwater and surface water is such that either can contaminate the other, given the right conditions.

IMPACTS OF IMPROPER DISPOSAL

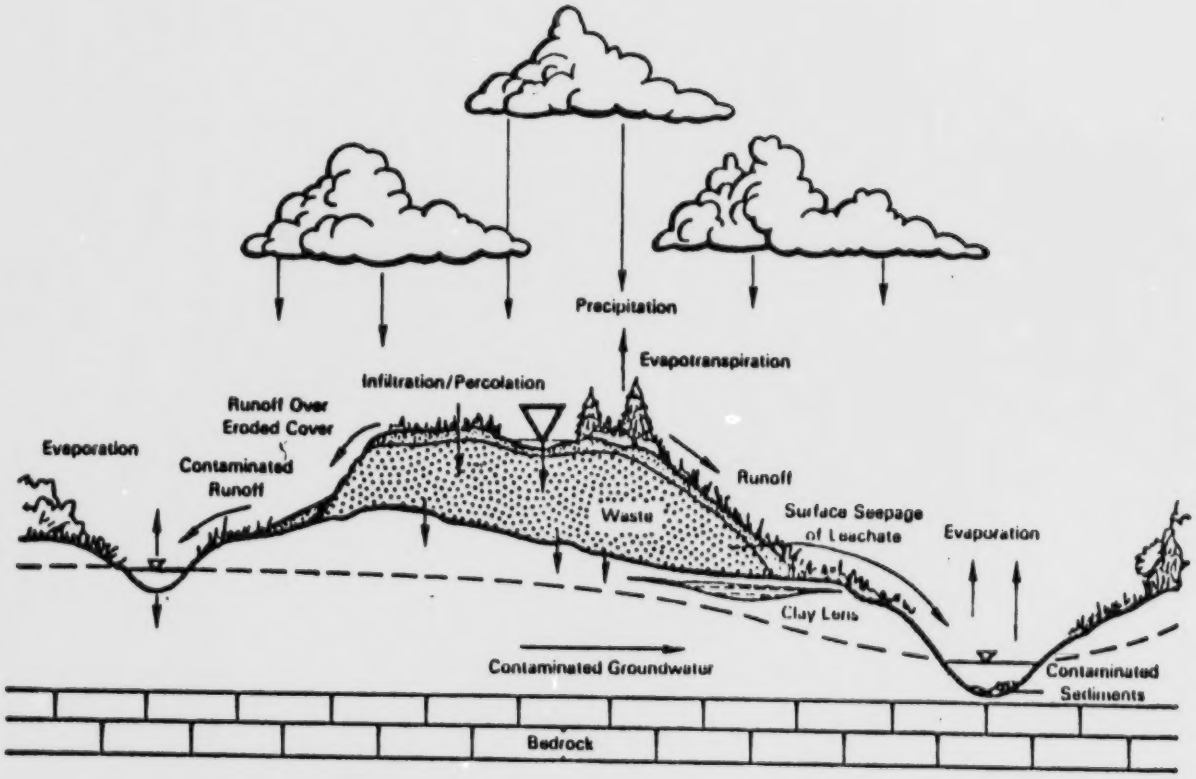
The environmental problems caused by polluting land disposal sites may be:

- localized or widespread;
- direct or indirect;
- apparent or obscure; or
- short term or long term.

Figure 2-3 illustrates the flow of land-disposed waste contaminants through the environment and to various receptors. Obvious effects of a polluting disposal site may include contamination of a local drinking water well, direct inhalation of waste fumes by nearby workers and residents, or contamination of surface water by a leachate surface seep. On the more obscure side, contamination of an aquatic chain may occur via biological uptake of settled wastes by benthic organisms. Also, a major municipal water supply may experience a slow long-term degradation in water quality or an explosion in a basement may occur as a result of lateral methane migration from a landfill closed years ago.

FIGURE 2-2

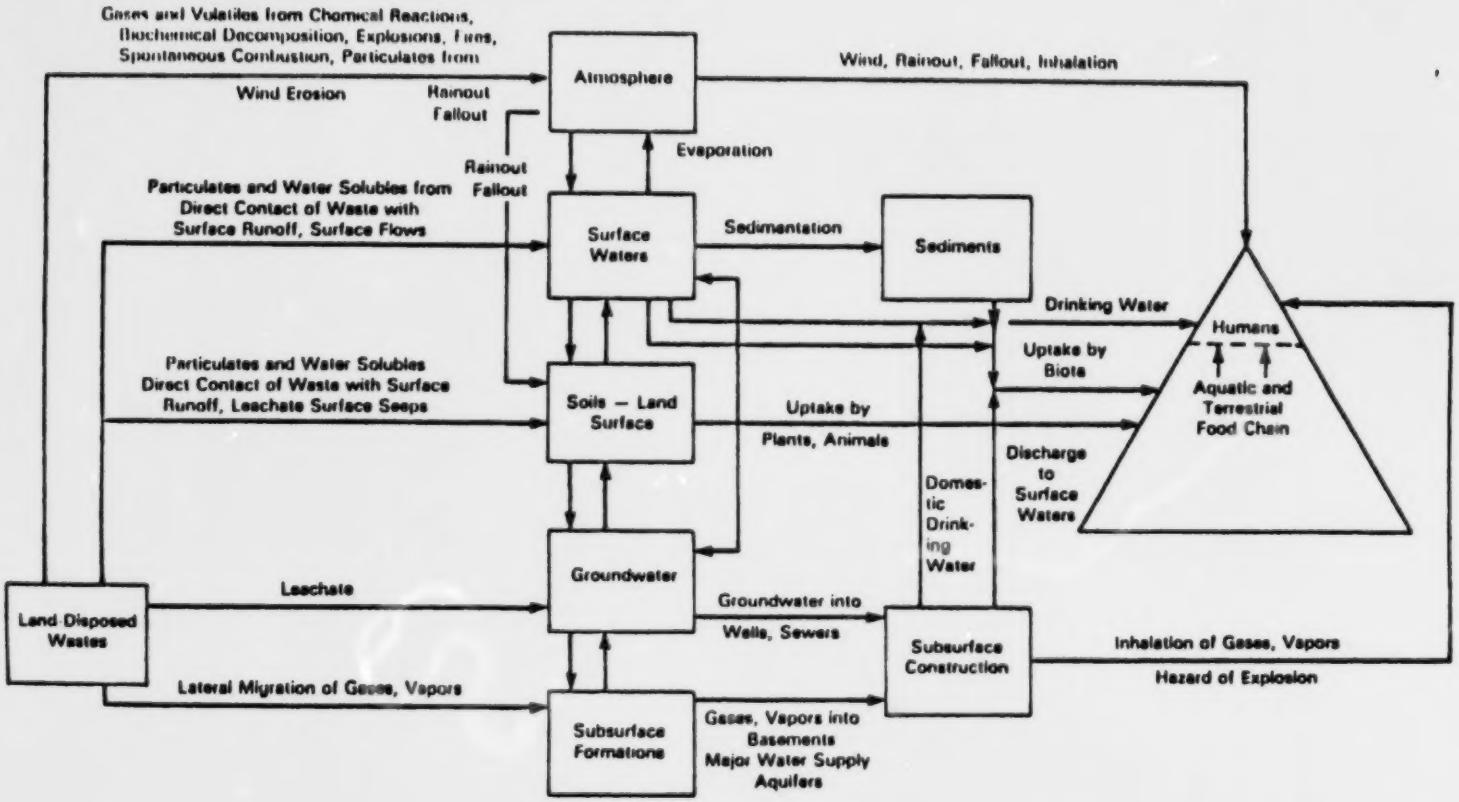
HYDROLOGIC PATHWAYS FOR CONTAMINATION BY WASTE DISPOSAL SITES



SOURCE: AFTER U.S.E.P.A., 1982

FIGURE 2-3

FLOW OF LAND DISPOSED WASTE CONTAMINANTS THROUGH THE ENVIRONMENT



SOURCE: AFTER U.S.E.P.A., 1982

To eliminate any identified or perceived adverse impacts from existing disposal sites, requires the establishment of an effective remedial action plan. The remedial plan must take into account all of the pathways involved in the transport of contaminants through the environment (see Chapter 6).

CHAPTER 3
ALBERTA OVERVIEW

INTRODUCTION

Alberta Environment, as the lead agency in the province with respect to waste management, has endeavoured to ensure that impacts of improper waste disposal are not experienced here. Recognizing the need to identify waste disposal sites (as mentioned in Chapter 1) and understanding the problems posed by disposal sites (as described in Chapter 2) they have embarked on a multi-phase program:

Phase 1 Identification and verification of active and inactive land disposal sites, together with available data on the nature and quantity of materials deposited therein.

Phase 2 Preliminary assessment through site visitation of the manifested or potential impact of each site on public health or the environment.

Phase 3 Examination of candidate sites, via field sampling programs, to verify the preliminary assessment.

Phase 4 Undertaking of remedial actions to ensure any identified site problems are eliminated.

Phase 1 of this multi-phase program has been completed. Phase 1 was the MacLaren Plansearch study referred to in Chapter 1. Phase 2 is this report, which will build on the initial findings of the MacLaren study and further advance the task of ensuring the prevention of adverse impact from disposal sites in Alberta. Phase 3 will take information developed in the first two phases

and will determine the nature and magnitude of impacts posed by waste disposal sites. Phase 4 will eliminate any site problems and ensure the environment and public health are protected.

The purpose of this Chapter will be to put into perspective, the known information about waste disposal sites in Alberta. The discussion will focus on the MacLaren Plansearch inventory of Alberta sites and the role of Government in dealing with these sites. Through this overview of Alberta conditions, one will become acquainted with the Alberta situation and the framework upon which solutions may be built.

The MacLaren Plansearch Study

The MacLaren Plansearch report, which was released in 1983, endeavoured to identify those sites within Alberta which had at some time past or present, accepted waste materials. Prior to the commissioning of the MacLaren Plansearch report, there was no comprehensive listing of waste disposal sites within the Province of Alberta. The MacLaren inventory of sites was prepared from:

- Alberta Environment Files;
- Alberta Social Services and Community Health Files; and
- Environment Canada Files.

File data was supplemented by a questionnaire sent to municipal officials and selected regional agencies. A small number of sites were then field checked by MacLaren Plansearch staff or local health inspectors.

A standard point scoring system was developed and used to screen the waste disposal sites. The point scoring system was based on site location, waste type and environmental criteria. Each site was assigned a point score and associated

priority ranking. The scoring system was first used in a similar New Brunswick site listing.

The MacLaren Plansearch study identified 1152 active and inactive disposal sites within Alberta. These sites were scored and placed into three priority levels:

Priority 1 Site has a combination of potential problems such as water supply contamination, close proximity to development, sandy soils or other reported environmental problems. These sites potentially pose a risk to human health, safety and the environment.

Priority 2 Site has only marginal problems and generally does not pose a risk.

Priority 3 Site poses few problems because they are well sited physically and socially.

In total, 167 sites (14%), were classified as potential Priority 1 sites. Generally, priority 1 sites were located close to, or within towns, close to municipal water supplies and also have some documented environmental problems such as leachate production, surface or groundwater contact or high concern wastes disposed at the site. Figure 3-1 identifies the location of the Priority 1 sites within Alberta and Appendix A lists the sites by location.

There were 292 (25%) sites classified as Priority 2. Generally, these sites did not appear to have as many problems as the Priority 1 sites.

A total of 693 sites (60%) were classified as Priority 3. These sites, as well as could be judged received wastes which were of low concern and have few if any, environmental problems.

FIGURE 3-1

ALBERTA PRIORITY 1 WASTE DISPOSAL SITE LOCATIONS

SOURCE: MacLAREN PLANSEARCH, 1983.

The value of the MacLaren report findings, is that through the point scoring system, potentially important sites have been identified. These 167 priority 1 sites must now be further researched to determine whether problems perceived in the office study, may in fact occur in the field. Chapters 4 and 5 address these field investigation studies.

ROLE OF GOVERNMENT

Alberta Environment, Alberta Department of Social Services and Community Health and municipal and regional governments, are presently playing key roles in controlling and managing waste disposal sites. Alberta Environment is the lead agency due to its broad environmental protection powers, its regulatory powers to control releases of chemicals to the environment and its technical and engineering staff. The Department of Health and Social Services has broad powers to protect public health through deployment of public health inspectors. The municipal and regional governments have knowledge of past disposal practices in their particular area and are vested with land use control authority needed to deter development in areas of waste disposal sites.

The role of municipal and regional government will vary with:

- the circumstances surrounding a waste disposal site;
- the professional capabilities of the municipality; and
- the wide range of available local resources.

In Alberta, municipalities with responsibility to manage their own wastes include Calgary, Edmonton, Lethbridge, Red Deer, Medicine Hat, Grande Prairie and Fort McMurray. All other areas in the province, the responsibility for waste management rests with Alberta Environment and Alberta Department of Social Services and Community Health.

On Federal lands within the province, such as indian reserves, Environment Canada is responsible for managing waste disposal practices. In addition, Environment Canada has worked in cooperation with Alberta Environment in areas of national concern and management. Environment Canada helped fund the MacLaren Plansearch study.

Alberta Environment

Alberta Environment has broad responsibilities to protect the environment. If in the department's opinion, an imminent hazard to the environment exists, the department will seek to abate this imminent hazard by ordering private citizens and corporations to cease and desist the offending activity.

The Department has specific powers to move against private citizens, corporations, or municipal governments if ground or surface water standards, air quality standards or other laws are being violated. The role of the Department in the past has been to monitor, assess environmental impacts, regulate and manage resources.

Major Alberta Environment programs and projects which address waste disposal practices include:

- Regional Solid Waste Management Assistance Program through the Waste Management Branch funding is made available to regional governments to eliminate small, poorly operated disposal sites and consolidate disposal activites to one properly operated site. Ideally, in the future, waste disposal will be restricted to 40 or 50 disposal sites rather than the 700 to 800 sites presently in use.

- Alberta Heritage Savings Trust Fund Land Reclamation Program through the Land Reclamation Division, local governments may apply to have their unwanted disposal sites reclaimed. Funding and management personnel are provided to ensure that reclamation is properly undertaken.

- Identification and Verification of Waste Disposal Sites is the cornerstone project, by the Waste Management Branch, to determine the impact of past disposal practices on the Alberta quality of life. Other studies include an evaluation of industrial disposal sites and an evaluation of geophysical methods to determine leachate migration at sites.

Alberta Department of Social Services and Community Health

The Alberta Department of Social Services and Community Health, through the Waste Management Act, has broad powers to protect public health as it may be affected by waste disposal sites. If, in the opinion of the Department's health inspectors, an imminent hazard to public health exists, they may take action to abate this imminent hazard by ordering private citizens, corporations, or governments to stop specified actions or take specific emergency measures.

CHAPTER 4
EVALUATION OF WASTE DISPOSAL SITES

INTRODUCTION

The MacLaren Plansearch Study identified 167 Alberta waste disposal sites as posing a potential hazard to human health and the environment. These findings were based on file data and office evaluations. The task now is to determine whether those perceived impacts for the 167 sites in the office have the potential to occur in the field. If they do, then which of the 167 sites may pose the greatest hazard. This chapter describes the methods used to further define the problems posed by Alberta waste disposal sites.

INDIVIDUAL SITE EVALUATION APPROACH

All 167 waste disposal sites were visited and interviews were held with site owners/operators/users. To properly assess a site, a system was required which accurately recorded information about that site. A site evaluation sheet was developed and is presented in the report pocket. The site evaluation sheet consists of seven information sections:

- site location map;
- site summary;
- site description;
- site information sources;
- site rating;
- site evaluation comments/action; and
- site photographs.

These seven areas will be used as a framework for describing the study methodology.

SITE LOCATION MAP SECTION

The site location map refers to a map of Alberta, upon which all 167 potentially dangerous waste disposal sites have been plotted. The source of information for this map was the MacLaren Plansearch report and provided the focus as to which sites required further evaluation. The plotting of these sites occurred prior to field visits thereby allowing for the development of a time and cost efficient visitation strategy. Also the incorporation of this map into the final data sheet allows a researcher to easily pinpoint the location of one site relative to another within the province.

SITE SUMMARY SECTION

The site summary section of the data sheet consists of six information requirements:

- site name;
- site number;
- site location;
- jurisdiction;
- point score; and
- relative ranking.

The intent of the site summary section is to provide a reviewer capsulized pertinent management information about a site.

Site Name

The name of the site was filled in on this line. The site name utilized in this study was the same as the name utilized in the MacLaren Plansearch report. No additional research was carried out. This was done deliberately to maintain consistency between studies.

Site Number

The site numbering system utilized in this study was a direct transfer of the MacLaren Plansearch system. Again, this was done deliberately to maintain consistency between studies. The site numbering system consists of two parts -- the municipality number and the site number within the municipality. For example, CO25/010 is site number 10 in County 25. The MacLaren study initially numbered the sites in tens so that insertions of sites could be made.

Site Location

The site location refers to the legal description of a site according to section, township, range and meridian. For most of the 167 sites, a legal location was provided by the MacLaren Plansearch Report. There were some locations however, which were inaccurate or missing altogether. This site information was obtained or verified during actual interview sessions held with site owners/ operators /users.

Jurisdiction

Refers to the City, County, Municipal District, Improvement District, or Special Area in which the site was located. This information was determined from an Alberta Municipal Boundaries map.

Point Score

The point score is the culmination of an evaluation of standard criteria for each site. A score in excess of 100 out of a maximum of 245 indicates undesireable site characteristics. The 100 point score level, denoting undesirable characteristics, was chosen arbitrarily by MacLaren Plansearch and retained in this study to maintain continuity between studies. Please see site rating section (on page 23) for more information.

Relative Ranking

This is a subjective classification which attempts to describe the potential posed by a waste disposal site. There are 5 site classifications. These classifications do not quantify probability or magnitude of any problems posed by the sites. Please refer to the site evaluation comments/action section for more information.

SITE DESCRIPTION

The intent of the site description section was to describe briefly, important physical and historical information regarding a site. The site description section of the data sheet consists of nine information requirements:

- site size;
- site status;
- site slope;
- date opened;
- date closed;
- expected life of site;
- site owner;
- site operator; and
- health unit.

Site Size

Refers to the size of a site usually in acres. The MacLaren report had this information recorded for approximately 80 percent of the sites. The source of the MacLaren data was usually site permits. The recorded MacLaren size information was verified and data gaps filled during the site visit and interviews.

Site Status

The site status refers to whether the site was active or inactive and was recorded as such. An active site was one which was being used in 1984 for disposal of waste. An inactive site was one which at some time in the past, had accepted waste materials. It was recognized that the two year difference between the submission of the MacLaren report and the commissioning of this report, some sites may have changed their status. The site visits undertaken in this study, confirmed the status.

Site Slope

Site slope information was recorded in the data sheet because sites located in steep slope areas have a higher potential for surface or groundwater contamination than sites located on level ground. Site slope data was obtained from observations made during the site visit.

Date Opened

Refers to the time when the site first accepted waste materials. This data was obtained during site interviews when known, or from MacLaren Plansearch project files.

Date Closed

Refers to the time when the site stopped accepting waste materails. This data was obtained during site interviews when known, or from MacLaren Plansearch project files.

Expected Life of Site

Expected life of site applies to active sites and how much longer they may be used for waste disposal. The MacLaren Plansearch study had information on only 10% of the sites. This data was obtained where possible, during interviews with local officials and an analysis of the amount of land still available for waste disposal at a site during the site visit.

Site Owner

Site owner information was collected during interviews held with local officials. This information was then cross checked with data collected in the MacLaren Plansearch report.

Site Operator

Refers to who operated the site when it was in use. Site operator information was collected during interviews with local officials. This information was cross checked with data collected in the MacLaren report.

Health Unit

The health unit jurisdiction over the specified site was included here. The identification of the correct health unit was done via a health unit boundary map issued by Alberta Mapping and Air Photo.

SITE INFORMATION SOURCES SECTION

There were two types of information sources identified when data was being assembled for waste disposal sites. The first source was the original MacLaren Plansearch data. Information sources listed in the MacLaren report for a site were transferred directly to this section. This approach allows a site reviewer to identify all site information sources.

A second type of information source were those utilized by Associated Engineering. These information sources were tapped directly by Associated Engineering personnel when this study was being conducted. The names of persons interviewed for information, as well as confirmation that a site was visited is listed here.

RATING OF SITES SECTION

The sites were rated in two ways. In this section, the site was rated according to the Priority Point System. Under this system, each site was assessed with respect to its physical, environmental and social characteristics.

The priority point scoring system for evaluating the 167 waste disposal sites is based on a refinement of the MacLaren Plansearch criteria. The scoring system is designed to evaluate standard criteria for each site. A high score indicates undesireable site characterstics. The calculation of the point score is carried out on the site data sheets which are provided for each individual site.

There are eighteen scoring criteria which are awarded points according to a weighting system. A total number of 245 points may be awarded a site. A point score in excess of 100 points is viewed as a site which may be potentially causing a problem. The 100 point score level is an arbitrary one chosen by MacLaren Plansearch for their study and utilized here to maintain continuity.

The eighteen scoring criteria are divided under four major headings:

- hydrogeology (4 criteria - maximum 50 of 245 points);
- surface water (4 criteria - maximum 45 of 245 points);
- waste (2 criteria - maximum 35 of 245 points); and
- land use and management (8 criteria - maximum 115 of 245 points).

These headings help identify which factors contribute to a potential problem by a site and what the potential problem may be. The scoring criteria are discussed below.

HYDROGEOLOGY

Distance to Private Wells/Municipal Water Supply

Contamination of surface or groundwater potable water supplies by leachate is possible by waste disposal sites. This criteria was used to assign points to disposal sites which were within 8 km of a water supply. Points were awarded in proportion to the distance of the site from the water supply. Table 4-1 details the number of points which may be assigned to a site.

Information regarding the water supply criterion was collected from:

- site visits;
- interviews with local officials;
- MacLaren Plansearch data;
- Alberta Environment Municipal Engineering Branch; and
- Alberta Environment Water Rights Branch.

Once the water supply was identified, a distance measurement was taken on an aerial photograph, between the water supply and the disposal site. This measurement was then plotted on the aerial photograph.

General Soil Type

The general soil type criterion is important because the potential for leachate to travel away from the site must be assessed. Generally, porous soils such as gravel allows leachate to migrate, while silts and clays are less porous and restrict migration. Soil types were identified from hydrogeological reconnaissance maps, surficial geology maps, soils maps and cross checked with a site visit. Unfortunately no site sampling was done to confirm soil types. This lack of definitive data required that soil types be classified into three very general categories. These categories and their point scores are the same ones utilized by MacLaren Plansearch. Table 4-1 identifies the categories and their point scores.

TABLE 4-1
THE POINT SCORING SYSTEM

CATEGORY 1: HYDROGEOLOGY

Proximity to Municipal Water Supply:

0 - 1000 ft.	0 - 300 m	20 Pts.
1000 ft. - 1 mile	300 m - 1.6 km	10 Pts.
1 - 5 miles	1.6 - 8 km	5 Pts.
5 miles	8 km	0 Pts.

Distance to Private Wells:

Number of Wells	0-1000 ft. 0 - 300 m	1000 ft-1 mile 300 m - 1.6 km	1-5 miles 1.6 - 8 km	5 miles 8 miles
7 - 10	20 Pts.	20 Pts.	15 Pts.	0 Pts.
6 - 10	20	15	10	0
1 - 5	15	10	5	0
0	0	0	0	0

General Soil Type:

- Gravel and Sand — 10 Pts.
- Sandy Clay Till/Sandstone — 5 Pts.
- Clay/Shale — 5 Pts.

Contact with Water Table	Yes	10 Pts.
	No	0 Pts.
Groundwater Contamination	Yes	10 Pts.
	No	0 Pts.

TABLE 4-1
THE POINT SCORING SYSTEM

CATEGORY 2: SURFACE WATER

Proximity to Surface Water:

0 - 300 ft.	0 - 90 m	10 Pts.
301 ft - 1000 ft	91 m - 300 m	5 Pts.
1001 ft - 1 mile	301 m - 1.6 km	2 Pts.
1 mile	1.6 km	0 Pts.

Surface Water Use:

• Drinking Water	10 Pts.
• Recreational	7 Pts.
• Commercial or Industrial	7 Pts.
• Irrigation	5 Pts.
• Not Currently Used	0 Pts.

Surface Water Contamination	Yes	10 Pts.
	No	0 Pts.

Flood Potential

• Flooded Annually	15 Pts.
• On Flood Plain	5 Pts.
• Outside Flood Plain	0 Pts.

CATEGORY 3: WASTE

Type of Waste

• High Concern Wastes	20 Pts.
• Medium Concern Wastes	10 Pts.
• Low Concern Wastes	5 Pts.

Volume of Waste

Cu. M	Cu. Yds.	Tonnes	Tons	No. of Drums	
1900	2500	1130	1250	10,000	15 Pts.
951 - 1900	1251 - 2500	571 - 1130	626 - 1250	5001 - 10,000	10 Pts.
191 - 950	251 - 1250	111 - 570	126 - 625	1001 - 5,000	5 Pts.
8 - 190	11 - 250	5 - 110	6 - 125	41 - 1,000	3 Pts.
0 - 7	0 - 10	0 - 4	0 - 5	0 - 40	1 Pt.

TABLE 4-1
THE POINT SCORING SYSTEM

CATEGORY 4: LAND USE AND MANAGEMENT

Surrounding Land Use & Proximity to Development:

Type of Development	0 - 1000 ft 0 - 300 m	1001 ft - 1 mi 300 m - 1.6 km	1 - 5 miles 1.6 - 8 km	5 miles 8 km
Residential or proposed housing sites	20 Pts.	10 Pts.	5 Pts.	0 Pts.
School, play-ground or public places	20	10	2	0
Commercial or Industrial	20	10	2	0
Agriculture	5	3	1	0

Distance to Sensitive Environment or Critical Habitat:
(Animal Sanctuaries etc.)

0 - 1000 ft.	0 - 300 m	10 Pts.
1000 ft. - 1 mile	301 m - 1.6 km	5 Pts.
1 - 5 miles	1.6 - 8 km	2 Pts.
5 miles	8 km	0 Pts.

Method of Operation:

- Open Dump — 15 Pts.
- Open Dump with Burning — 10 Pts.
- Modified Landfill — 10 Pts.
- Dry Dump — 5 Pts.
- Sanitary Landfill — 2 Pts.

Odour

Yes	5 Pts.
No	0 Pts.

Rehabilitation of Old Sites

- No Cover — 15 Pts.
- Not Landscaped - Natural Regrowth — 10 Pts.
- Landscaped - Recreation Facilities — 5 Pts.
- Residential — 5 Pts.
- Open Space — 0 Pts.

Water Table Contact

Water table contact was utilized as an evaluation criterion because this is the first indication of the potential for groundwater contamination. Points were assigned if water table contact was made as described in Table 4-1. Information regarding water table contact was obtained during the site visit, from any site specific hydrogeological reports available and local official interview.

Groundwater Contamination

This criterion is an extension of the water table contact criterion. Points were assigned to a site if groundwater contamination had occured or if there was a possibility of it occuring. Table 4-1 specifies the number of points awarded. Information regarding groundwater contamination was obtained in a manner similar to that for the water table contact criterion. Data was collected during site visit, from any site specific hydrogeological reports available and local official interview.

SURFACE WATER

Distance to Surface Water

This evaluation criterion assesses the potential for contamination of lakes, rivers and creeks due to their proximity to a waste disposal site. The following factors were considered when determining the potential for contamination:

- size of water body;
- direction of flow (river or stream); and
- probability of surface runoff from the disposal site.

The information regarding surface water distance was obtained from three sources:

- local official interviews;
- 1:250,000 map sheets; and
- disposal site aerial photographs.

Point scores awarded for distance to surface water are provided in Table 4-1.

Surface Water Use

Leachate from disposal sites can contaminate surface water. This environmental problem is compounded if a surface water body is used for municipal, industrial, agricultural or recreational purposes. Points were assigned to a site according to the scoring system in Table 4-1. Information concerning the use of surface water was obtained from interviews with local officials.

Surface Water Contamination

Surface water contamination by a disposal site was rated as having occurred or not having occurred. Where there was doubt, a possible rating was assigned and full points awarded. This approach ensures that any error would be in favour of protecting the environment and public health. Information regarding surface water contamination was gleaned from local official interview, site visit and hydrogeology reports done previously. Point scores awarded for surface water contamination are provided in Table 4-1.

Flood Potential

Points were awarded to a site if it was located within a clearly defined floodplain. There are no provincial maps designating flood plains, so assessments were made based on local official interview, site visit and aerial photograph

interpretation. Point scores awarded for a site being potentially flooded are provided in Table 4-1.

WASTE

Type of Waste

Waste can be classified according to the risk it poses to the public. Hazardous, institutional and radioactive waste, for example, pose a greater risk than municipal waste. The type of waste at a disposal site was classified in this study, into three levels of concern according to guidelines provided by Environment Canada and utilized by MacLaren Plansearch. Classification of waste types was retained to maintain consistency between reports.

High Concern Wastes

- wastes on Federal Interim List of Dangerous Wastes;
- wastes identified by the Province of Alberta as hazardous wastes;
- materials regulated by the Environmental Contaminants Act;
- institutional (laboratory, school, hospital) wastes;
- pathological wastes;
- low level radioactive wastes.

Medium Concern Wastes

- liquid wastes not referred to above, including waste oils and septic pumpings;
- empty pesticide containers; and
- incinerator residues.

Low Concern Wastes

- municipal solid (household) waste; and
- industrial and commercial solid waste such as construction materials.

Information concerning the type of waste disposed at a particular site was one of the more difficult pieces of data to obtain. At inactive sites, the type of waste disposed, was inferred from interviews held with local officials. At active sites, information regarding waste types disposed was collected during local official

interview and cross checked through a cursary study of the disposal site. Photographs of waste exposed at a site were taken so that a record of waste deposited at a site would be available. Point scores awarded for type of waste are provided in Table 4-1.

Volume of Waste

Volume of waste is an important criterion for three reasons:

- production of significant volumes of leachate generally increases with the volume of waste deposited at a site;
- larger sites have a higher potential for deposition of a wider variety of wastes; and
- provides an indication as to the level of effort required to clean up a site.

The volume of waste can be expressed in terms of cubic metres, cubic yards, tonnes, tons, or number of drums. For this project, waste volumes disposed were expressed primarily in cubic metres.

The volume of waste disposed at a site was the most difficult piece of data to acquire about a site. Ideally weigh scales would have been in place at all the disposal sites during site operations recording waste amounts received. Unfortunately, weigh scales are only required at sanitary landfills in the province. Of the 167 sites surveyed in this study, only 5 were classified as sanitary landfills and had a scale system in place. Consequently, alternative methods to estimate waste in place were needed. One of these alternative methods determined the number and dimensions of trenches at a disposal site. Once trench characteristics were known, a volume calculation was undertaken. A second less accurate alternative method utilized the area of the disposal site to provide an indication of waste amounts disposed.

LAND USE AND MANAGEMENT

Surrounding Land Use

This criteria is used to identify higher risk sites located beneath or adjacent to urban developments. Distances were measured to:

- residential areas;
- schools;
- commercial establishments; and
- agricultural areas.

The distances to the above 4 land use areas were obtained from an aerial photograph for each site. The distances were cross checked through site visit and local official interviews. Local officials were asked to detail any development plans for the area. Point scores assigned for disposal site proximity to surrounding land use is provided in Table 4-1.

Distance to Sensitive Environment/Critical Habitat

This criterion designates the sites that could potentially affect critical biological habitats or park reserves. These critical areas include ecological reserves, natural areas, provincial parks and national parks. The 1:1,000,000 Alberta map showing ecological reserves and natural areas was used as the primary data source. In addition to the parks and reserves mentioned above, if during interviews with local officials an area important to the local populace was uncovered (such as a Kiwanis fish pond), this was included under the sensitive environment definition. Point scores assigned for disposal site proximity to a sensitive/critical environment is provided in Table 4-1.

Method of Operation

Waste disposal sites were classified by method of operation as defined by the

Provincial Board of Health Regulations. In decreasing order of potential hazard to the environment they include:

Open Dump	• rarely compacted and covered.
Modified Landfill	• refuse deposited in a trench; and • compacted and covered as required.
Dry Dumps	• non-offensive waste (construction); and • ultimately covered.
Sanitary Landfill	• site is engineered to eliminate groundwater contamination; and • daily or frequently compacted and covered.

As part of regional waste management systems, transfer stations are used for temporary storage of waste before it is hauled to a regional sanitary landfill. Transfer stations were included in the inventory because inactive land disposal sites were frequently found at the same location. In all 5 transfer stations were evaluated.

The method of operation was identified through site visit in the case of active sites and through local official interview for the inactive sites. Where the method of operation could not be verified, it was assumed to have operated as an open dump prior to 1970 and as a modified landfill post 1970. These assumptions reflect the predominant method of disposal in Alberta during those years. Point scores assigned to a disposal site based on its method of operation are provided in Table 4-1.

Odour

The odour of a site could provide clues as to the possibility of generation of methane or other gases on one hand, to the more mundane, but equally important nuisance factor of odour from rotting waste or burning. Points were assigned according to whether or not odour was evident during the site visit. Table 4-1 details the number of points assigned.

Rehabilitation of Inactive Sites

A score was awarded for the current use of inactive sites. A high score was assigned for uses that involve people in an indoor environment. A low score was assigned for outdoor uses such as parks or agriculture. The information regarding site use was obtained during the site visit. The magnitude of points assigned to a site depending on its rehabiliated use is provided in Table 4-1.

ANALYSIS OF PRIORITY POINT SCORE SYSTEM

Now that the priority point scoring system to rate disposal sites in this study has been described, the reasons for the approach taken must be discussed. The best way to describe the approach is to compare the system utilized in this study with its predecessor in the MacLaren Plansearch report. The discussion will focus on:

- number of criteria;
- criteria weighting: and
- quality of information.

Number of Criteria

In the MacLaren Plansearch report, the priority point score system was adapted from a New Brunswick study, which through the Federal Department of the Environment was being applied nationally. In this system, 24 scoring criteria were used. It is apparent from a review of the MacLaren study that all 24 criteria were important pieces of information however, not all are required to evaluate a disposal site in Alberta.

The criteria dropped from the priority point ratings include:

- population served by water supply: because approach was taken that any size population affected is unacceptable;

- environmental problems - leachate: because other criteria such as water table contact, groundwater contamination and surface water contamination covered this aspect.

- average moisture surplus: because there are no significant areas in the province where precipatation exceeds evaporation.

- site slope: was seen to add little to overall site ratings, (site slope although not rated was retained for site description purposes).

- other problems category: was not considered important because surface water, groundwater, and human concerns were covered by other criteria.

Two other criteria were combined into one - proximity to municipal water supplies and distance to private wells became distance to private wells/municipal water supply. This combination of criteria reflects the approach that all water sources are equal and important.

Criteria Weighting

The actual point weightings awarded to the 18 criteria utilized in this study are exactly the same as those which were awarded in the MacLaren Plansearch study. This approach was taken to maintain consistency between reports.

Quality of Information

There are a number of problems associated with the type of information presented in the MacLaren Plansearch report. The main problems with the MacLaren site information are:

- data was collected from small scale maps;

- a low level of quality questionnaire responses; and
- data was obtained from files only rather than in conjuction with site visitation.

The MacLaren Plansearch study utilized 1:250,000 map sheets to identify the nearest surface water features. On these maps, however, only the larger water bodies are illustrated. In this study, larger scale aerial photographs in conjunction with site visits, were utilized to identify small creeks which could be affected by the site.

The questionnaire response obtained by MacLaren Plansearch during their site evaluation was an exceptionally high 78%. However, the quality of the data provided was poor. There were partially completed forms, confusing answers and incomplete answers. To rectify this situation, personal interviews were held in this study with site owners/operators/users. These interviews and site visits in this study were also important in alleviating the third problem with MacLaren information that being file data collected for a site was not verified.

SITE EVALUATION COMMENTS/RECOMMENDATION FOR ACTION SECTION

In this section of the data sheet, comments regarding site operations, site hydrogeology, surface water, waste, land use and management, site monitoring and site rating were made. The intent was to expand on the rigid rating data provided in the previous section. This additional insight will help to make the necessary evaluations, to determine the recommended action that should be taken at a site. The site evaluation comments were made when all the MacLaren information had been reviewed and site visits and local official interviews were complete. Once the site information was recorded, a plan of action for the sites was required. In the recommendation for action portion of this section, the sites were classified into categories. The site classification system is discussed below.

Site Classification System

Associated Engineering developed the site classification system to help identify which sites pose the greatest potential of adversely impacting health and the environment. The Associated Engineering site classification system consists of five classifications. The site classifications are detailed in Table 4-2. All sites were assigned a site classification based on: file data; interviews; priority point score; and observations made during the site visit.

The site classification system was developed because the priority point score system (utilized by MacLaren Plansearch) does not properly deal with factors not part of, or biased by, the priority point score system. Factors not part of the priority point score system which are considered by the site classification system include:

- existence and results of monitoring/testing programs; and
- success of site rehabilitation.

A site would receive a lower site classification if testing had been carried out and those tests indicated problems at the site. Conversely, a site would receive a higher site classification, if problems at a site were revealed through the testing programs. Similar conclusions would be reached on a site's classification, when success of rehabilitation is considered.

An example of factors being biased by the priority point system may be illustrated by the following example: A private well may be relatively near a site, if it is located on a height of land or across a river, it will not be impacted to the degree a well on the same side of the river at the same height as the site will be. The reason for less impact on the first well is that the height of land and the river act as physical barriers, thereby restricting contaminant migration towards that site. In the priority point score system, the points awarded to distance from private well would be the same.

TABLE 4-2
THE SITE CLASSIFICATION SYSTEM *

Class	Description
1	Potentially posing a danger of causing irreversible or irreparable damage to the public health or environment - action required.
2	Potentially posing a threat to the public health or environment - action required.
3	Does not present a significant threat to the public health or environment - action may be deferred.
4	Site properly closed or operated - requires continued management.
5	Site properly closed or operated, no evidence of present or potential adverse impact - no further action required.

* Note under this classification system, there is no quantification of probability or magnitude of harm. Quantification may only be done when field tests are conducted to delineate site problems (such as installation of monitoring wells).

It should be noted at this point, that the purpose of the site classification system is to complement the priority point score system, not replace it.

SITE PHOTOGRAPHS

In this final section of the individual site data sheet, a photographic record of site conditions is presented. A panoramic view of all sites was taken. In the case of active waste disposal sites, a photograph of the trench and waste types was also taken. The use of these site photographs in conjunction with the aerial photographs presented for each site, should allow an in office check of site ratings, without visiting the site again.

RELATIVE RANKING OF SITES

Once all the sites were evaluated individually, as described in the previous sections, a relative ranking was required to determine which sites should be first addressed in any following studies, because they pose the greatest potential hazard to Alberta human health, safety, and the environment. To determine relative rankings, the two methods used to rate the sites - the priority point score system and the site classification ranking system was utilized.

In comparison, the MacLaren Plansearch report utilized only the priority point score system and ranked the sites relative to one another according to their scores. The highest scored site posing the greatest potential problems and the lowest scored site posing the smallest potential problem.

In determining the relative rankings of the 167 disposal sites studied, the following steps were taken:

1. Separate all sites into their respective site classification categories.

2. List the sites within the site classifications according to their priority point scores - highest score being the greatest potential polluter in a class.

This approach resulted in a relative ranking of sites. This ranking is described in Chapter 5.

CHAPTER 5
RESULTS AND DISCUSSION

INTRODUCTION

This Chapter presents the findings of the 167 waste disposal site evaluations. The evaluations and relative rankings are based on file information, interviews, and a walk around the actual site. It should be noted, that no direct sampling of soil, water or waste was undertaken during this study. Until this sampling is done, no hard evidence is available to verify the existence or extent of any problems posed by the site. These evaluations and rankings are meant to direct in an environmentally prudent and cost effective manner the direct sampling programs required. Any new information received regarding a site should be incorporated and the site evaluation and rankings changed accordingly.

INDIVIDUAL SITE EVALUATION RESULTS

All 167 waste disposal sites identified as potentially posing a hazard to human health and the environment were evaluated. The results for each specific site are provided in site evaluation Volumes 1 through 11. Information presented for each site includes an aerial photograph and a data sheet.

The 100 cm^2 aerial photograph identifies where possible:

- site boundaries;
- surrounding land use;
- groundwater recharge areas; and
- surface water features.

In addition, a radiating 500 metre grid has been superimposed on the aerial photograph in order to aid observers in determining the proximity of the site to important features. The data sheets adjacent to the aerial photograph present site description, site management and site rating information.

RELATIVE RANKING OF WASTE DISPOSAL SITES

To rank the 167 sites in relation to one another, the site classification system (see Chapter 4) was used in conjunction with the priority point score system (see Chapter 4). The results of the relative rankings are discussed below according to the site classification system.

Class 1 Sites

Class 1 sites were those assessed as potentially posing a danger of causing irreversible or irreparable damage to the public health or environment. Action must be taken to assess and alleviate the problem at these sites. Of the 167 waste disposal sites evaluated, 18 waste disposal sites were judged to be Class 1. This represents 11% of the total sites studied.

Table 5-1 lists the identified Class 1 disposal sites, their site location and the volume in which their individual aerial photographs and data sheets may be found. The sites are listed on the table in order of their priority point score. High Prairie with the highest point score of 158, is judged to be posing the greatest potential hazard of all sites in Alberta. Kinbrook Island is the second most important site in the province requiring redress and Linden at the bottom of the table with a priority point score of 90 is the eighteenth most important. Figure 5-1 illustrates the location of the Class 1 waste disposal sites.

A review of the Class 1 priority point scores reveals that 95% of the sites or 17 of 18, have scored over 100. The 100 point level was the arbitrary line drawn in the MacLaren report designating Priority 1 sites. This rating in excess of 100 signifies that these sites are:

- located close to or within towns;
- close to water supplies; and
- may have some environmental problems (leachate production, surface or groundwater contact or high concern wastes).

Linden, the only site below 100 exhibits an exceptionally high potential for damage in one specific area of concern.

Due to the importance of Class 1 sites, the study findings regarding these sites are capsulized below. The capsulized comments, however, should only be used in conjunction with the site data sheets provided in the site evaluation volumes.

- High Prairie - ID 17/200 - has a daycare centre situated on top of the site. In addition, waste washes into the adjacent recreational river during spring freshet and there is a methane gas problem.

- Kinbrook Island CO 4/095 - is located on an island in Lake Newell which is a drinking water source for Brooks and other small towns, as well as a major recreational lake. This site is underwater on occasion during spring freshet.

- Edson ID 14/050 - is located in a swamp, there is leachate generation and water table contact. Bench Creek may be adversely affected as well as the nearest drinking water well 150 metres away.

- Manola CO 11/090 - is located adjacent to the Pembina River a major source of drinking and agricultural water. In addition the river is used for recreation. Waste is near and in the past, actually in the river.

- Donnelly MD 130/020 - is an inactive site, never properly reclaimed and located adjacent to the Village of Donnelly drinking water channel.

- Minburn CO 27/050 - is located adjacent to a school, in sandy soils close to town whose residents depend on shallow wells - less than 10 metres deep for their water supply.

- Red Deer Motors RD 007 - is located adjacent to a creek which runs through a Red Deer residential area.

- Ferintosh CO 22/100 - is located adjacent to a lake which is used as the Village of Ferintosh water supply and promoted as a major recreational resource.

- Hartell MD 31/090 - is located on the side of a coulee from the bottom of which a creek runs. This creek is utilized as a drinking water source by a dairy farmer across the coulee.

- Animal Diseases Research Institute CO 26/010 - is located on the flood plain of the Oldman River which is utilized for drinking water and recreation. High hazard wastes such as diseased animals and incinerator ash are dumped here. A.R.D.I. personnel noted that underground streams run through this area.

- Czar MD 52/050 - is located in sandy soils near the Village of Czar, whose residents obtain their water from shallow sand lense wells.

- Gleichen CO 16/090 - is located within 10 metres of the Town of Gleichen water reservoir. Numerous pesticide and chemical cans have been dumped here.

- Paradise Valley CO 24/100 - site is located adjacent to a large surface water body which is potentially being affected and there is evidence of vegetation kill around the site.

- Montfort School RD/005 - is located in the centre of a residential area in Red Deer. Additional information is required on the waste amounts disposed.

- Red Deer CO 23/177 - is located adjacent to the Red Deer River which is used for recreation and drinking water. Numerous underground streams run through the area and there is evidence of leachate.

- New Sarepta CO 25/170 - is located extremely close to town and a nearby drinking water well. Complaints about this site have been received in the past.

- Glenwood MD 6/040 - is located in a slumping bank area on the side of a river used for recreation. Surface runoff runs right through the covered garbage and into the river.

- Linden MD 48/080 - a residence has been established on top of the disposal site complete with a drinking water well. No information is available, however, on how the well was drilled and finished.

TABLE 5-1

ALBERTA CLASS 1 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
High Prairie	ID 17/200	SE 26-74-17 W5	11	158
Kinbrook Island	CO 4/095	19-17-14 W4	2	146
Edson	ID 14/050	NE 09-53-17 W5	7	145
Manola	CO 11/090	NE 16-59-02 W5	9	132
Donnelly	MD 130/020	SE 12-78-21 W5	11	132
Minburn	CO 27/050	SW 14-50-10 W4	8	130
Red Deer Motors	RD 007	SE 08-38-27 W4	4	130
Ferintosh	CO 22/100	NW 03-44-21 W4	6	128
Hartell	MD 31/090	NE 09-19-02 W5	1	128
Animal Diseases Research Institute	CO 26/010	NE 12-09-22 W4	2	127
Czar	MD 52/050	SE 20-40-06 W4	6	127
Gleichen	CO 16/090	SW 24-22-23 W4	5	124
Paradise Valley	CO 24/100	NW 07-47-02 W4	8	115
Montfort School	RD 005	NW 20-38-27 W4	4	115
Red Deer	CO 23/177	NW 34-38-27 W4	4	113
New Serepta	CO 25/170	NW 34-49-22 W4	7	112
Glenwood	MD 6/040	SW 01-05-27 W4	1	111
Linden	MD 48/080	SE 20-30-25 W4	5	90

TOTAL NUMBER OF CLASS 1 SITES IS 18, OUT OF 167 SITES EVALUATED.

FIGURE 5-1

ALBERTA CLASS 1 WASTE DISPOSAL SITE LOCATIONS

Class 2 Sites

A Class 2 site was assessed as potentially posing a threat to the public health or the environment. Action is required at these sites to determine whether there is a problem. A total of 40 waste disposal sites are assigned a Class 2 classification. This represents 24% of the 167 site total. Table 5-2 lists these sites in decreasing order of priority point scores. Red Deer CO 23/176, the site first on the Class 2 list, should be the first site addressed once all the Class 1 sites have been finished. The Red Deer site is in effect, number 19 in priority in the province, under this ranking system. Figure 5-2 pinpoints all the Class 2 sites within the province.

A review of Table 5-2 reveals that 32 or 80% of the sites scored in excess of 100 priority points. This indicates that the bulk of the Class 2 wastes are located in or near sensitive areas, such as towns or cities, high groundwater areas, or surface water features. This rating in excess of 100 may also indicate that a high hazard waste was disposed there.

The 8 sites or 20% of the total Class 2 sites which scored below 100 indicate that those sites pose a potential hazard in a specific area, be it groundwater, surface water, waste or land use. For these sites, remedial action planning should investigate which factors are being threatened.

TABLE 5-2

ALBERTA CLASS 2 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
Red Deer	CO 23/176	SE 28-38-27 W4	4	155
Spring Coulee	MD 6/130	SW 28-04-23 W4	1	143
Olds	CO 17/080	SW 01-33-02 W5	3	134
Mannville	CO 27/040	NE 25-50-09 W4	8	130
Black Diamond	MD 31/020	NW & SW 16-20-02 W5	1	130
Grande Prairie	CO 1/100	E 11-71-06 W6	11	129
Taber	MD 14/090	SW 12-10-17 W4	2	129
Frank	ID 5/050	SW 30-07-03 W5	1	129
Rosebud	CO 16/160	SW 18-27-21 W4	5	127
High River	MD 31/110	SW 05-19-28 W4	1	125
Rocky Mountain House	ID 10/100	SE 19-39-07 W5	4	124
Magrath	MD 6/100	NE 26-05-22 W4	1	120
Fahler	MD 130/030	SE 04-78-21 W5	11	119
Frontier Farms	EDM 020	SE 07-53-23 W4	7	118
Ardrossan	CO 20/010	SE 05-53-21 W4	7	117
Mallaig	CO 19/100	N 24-60-10 W4	10	117
Girouxville	MD 130/040	SE 17-78-22 W5	11	113
Radway	CO 7/090	SW 32-58-20 W4	9	112
Innisfree	CO 27/010	NE 03-51-11 W4	8	110
Chipman	CO 30/040	NE 30-54-18 W4	8	110
Millet	CO 10/130	SW 33-47-24 W4	7	110
Camrose	CO 22/060	NE 21-46-20 W4	6	109
Okotoks	MD 31/130	NW 21-20-29 W4	1	107
Bashaw	CO 22/020	SW 02-42-21 W4	6	107
Provost	MD 52/115	SW 18-39-02 W4	6	107
Bow Island	CO 8/010	NW 13-11-11 W4	2	105
Rockyford	CO 16/140	SW 22-26-23 W4	5	105
Blackfoot	CO 24/010	NE 01-50-02 W4	8	105
Hinton	ID 14/090	NE 11-51-25 W5	7	102
Donalda	CO 6/070	SW 05-42-18 W4	6	102
Dogpound	CO 17/070	SW 05-29-03 W5	3	102
Mossleigh	CO 21/130	SE 30-20-24 W4	1	100
Bragg Creek	MD 44/80	NE 13-23-05 W5	3	97
Bowden	CO 23/030	NE 14-34-01 W5	4	95
Waskatenau	CO 13/065	SE 09-59-19 W4	10	95
Bawlf	CO 22/030	SW 31-45-17 W4	6	93
Hughendon	MD 52/070	W 04-41-07 W4	6	92
Warburg	CO 25/240	NE 26-48-03 W5	7	90
Marwayne	CO 24/100	NE 26-52-03 W4	8	87
Carstairs	CO 17/030	SW 09-30-01 W5	3	85

TOTAL NUMBER OF CLASS 2 SITES IS 40, OUT OF 167 SITES EVALUATED.

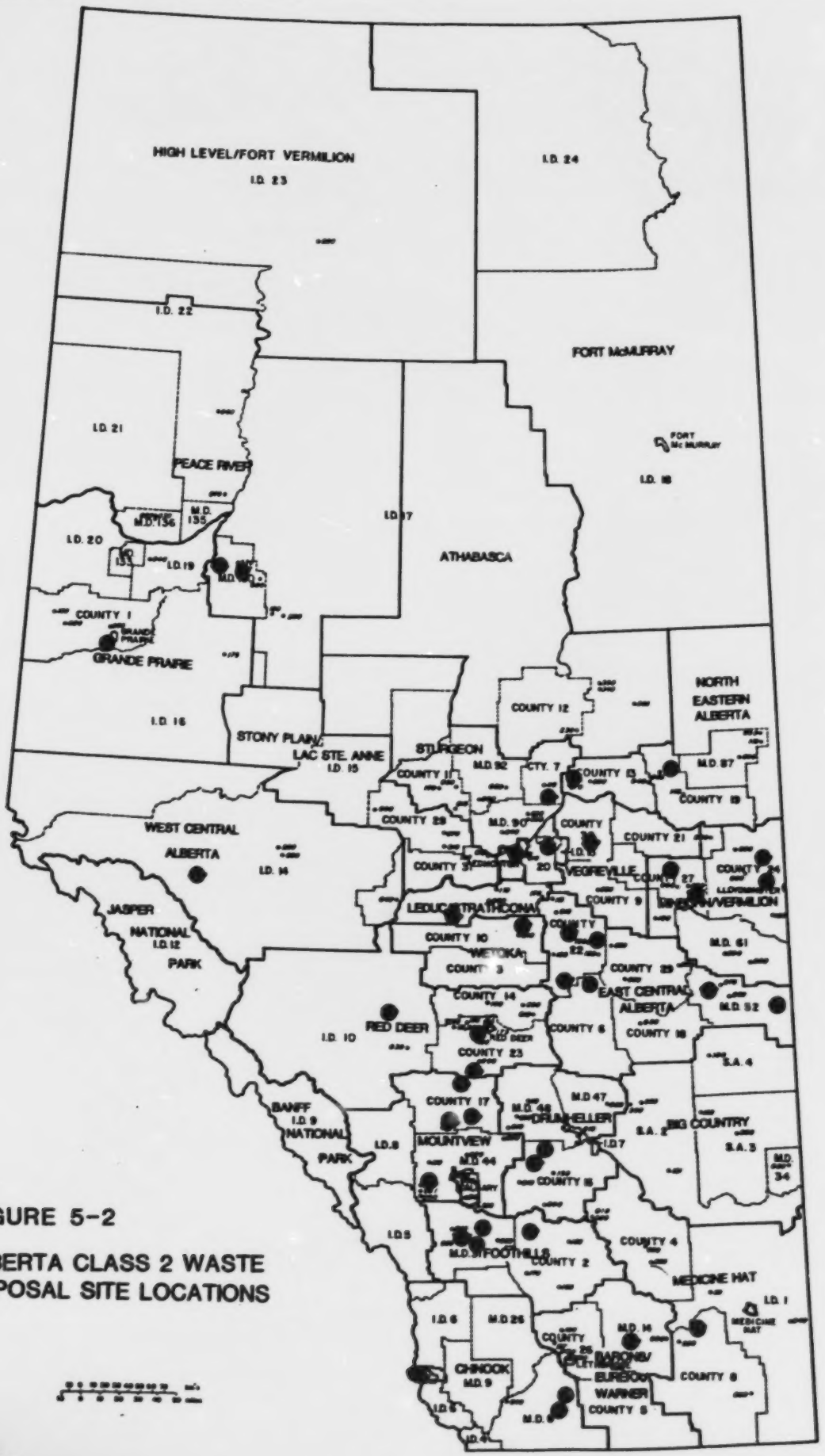


FIGURE 5-2

ALBERTA CLASS 2 WASTE DISPOSAL SITE LOCATIONS

Class 3 Sites

There were 53 sites out of 167 which were designated Class 3. This represents 32% of the waste sites evaluated. A Class 3 site does not present a significant threat to the public health or the environment. Action at these sites may be deferred until the 18 Class 1 sites and 40 Class 2 sites are dealt with. Table 5-3 lists the Class 3 sites in order of decreasing priority point scores. Figure 5-3 locates the sites on a map of Alberta.

There are 19 Class 3 sites with priority point scores in excess of 100. Under most circumstances, this would qualify them to be included in the Class 2 list. All of these sites in question, have factors which help to ensure that adverse impacts do not occur in the short term. This statement applies to all Class 3 sites. These factors include:

- reclamation has been undertaken at the site;
- the site is being, or has been, monitored in the past - therefore, data on site conditions is available;
- site is located in a physical environment which over the short term is adequate, however, over the long term, action is required to ensure the site is environmentally secure; and
- site has accepted low concern wastes only.

The Class 3 list of sites represents the largest category of disposal sites. Further information about these sites is available in the Site Evaluation Volumes 1 - 11.

TABLE 5-3

ALBERTA CLASS 3 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
Wetaskiwin	CO 10/210	SE 21-46-24 W4	7	129
Manning	ID 22/060	SW 27-91-23 W5	11	125
Rosalind	CO 22/180	SW 17-44-17 W4	6	122
Thorhild	CO 7/110	SW 05-60-21 W4	9	120
Standard	CO 16/190	SW 11-25-22 W4	5	120
McLennan	MD 130/080	NE 29-77-19 W5	11	120
Red Deer	CO 23/175	NE 33-37-27 W4	4	119
Alberta Beach	CO 28/010	SW 16 & 17-54-03 W5	7	118
Clover Bar	CO 20/019	NW 21 & S28-53-23 W4	7	117
Innisfail	CO 23/090	SW 29-35-28 W4	4	115
Forestburg	CO 29/050	NW 34-41-15 W4	6	115
Hardisty	CO 29/080	SE 12-43-10 W4	6	112
Lac La Biche	ID 18/286	SW 31-66-13 W4	10	107
Beiseker	MD 44/050	SE 11-28-26 W4	3	105
Vulcan	CO 2/170	SW 04-17-24 W4	1	105
Fort Kent	MD 87/090	SW 30-61-04 W4	10	103
Black Diamond	MD 31/040	SE 17-20-02 W5	1	102
Derwent	CO 21/020	SE 16-54-07 W4	8	100
Castor	CO 18/020	NW 03-38-14 W4	6	100
Cold Lake	MD 87/050	SE 23-63-2 W4	10	99
Lacombe	CO 14/160	SE 36-40-27 W4	4	99
Suffield	ID 1/110	NE 34-14-09 W4	2	95
Three Hills	MD 48/110	SW 36-31-24 W4	5	95
Cochrane	MD 44/110	SE 02-26-04 W5	3	95
Wanham	ID 19/040	SE 10-78-03 W6	11	94
West Edson	ID 14/050	NE 09-53-17 W5	7	93
Grassy Lake	MD 14/030	NW 15-10-13 W4	2	92
Delia	MD 47/020	NW 04-31-17 W4	5	92
Wainwright	MD 61/080	NE 30-44-06 W4	8	92
Scabbie Butte	CO 26/150	NW 17-11-22 W4	2	90
Alix	CO 14/010	NW 29-39-23 W4	4	89
High Prairie	ID 17/190	NW 24-74-18 W5	11	89
Hanna	SA 2/080	NW 16-31-14 W4	5	89
Double L	MD 90/050	SW & SE 05-56-23 W4	9	88
Lethbridge	LETH/030	06-09-21-W4	2	88
Gunn	CO 28/070	SE 10-55-03 W5	7	87
Blackie	MD 31/050	NE 13-19-27 W4	1	87
Clairmont	CO 1/060	SW 26-72-06 W6	11	86
Caroline	ID 10/030	NE 11-36-06 W5	4	85

TABLE 5-3

ALBERTA CLASS 3 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
Grand Centre	MD 87/110	SW 26-62-02 W4	10	84
Drumheller	ID 7/010	NE 36-28-20 W4	5	84
Manyberries	CO 8/060	SW 24-05-06 W4	2	82
Calmar	CO 25/050	NE 25-49-27 W4	7	82
Clandonald	CO 24/020	SE 17-53-05 W4	8	82
Clyde	MD 92/020	NW 36-59-25 W4	9	80
Blumenort	ID 23/020	NE 35-107-14 W5	11	77
Shepard	MD 44/220	SE 06-23-28 W4	3	74
Mannville	CO 27/030	SW 25-15-9 W4	8	72
Genstar	CO 31/010	NE 15-53-25 W4	7	72
Bassano	CO 4/020	NE 18-21-18 W4	2	70
Bassano	CO 4/010	NW 17-21-18 W4	2	65
Peace River	ID 22/075	SW 06-84-21 W5	11	69
Burdett	CO 8/020	NW 18-10-11 W4	2	65
Edgerton	MD 61/020	NE 35-43-04 W4	8	62

TOTAL NUMBER OF CLASS 3 SITES IS 54, OUT OF 167 SITES EVALUATED.

FIGURE 5-3

ALBERTA CLASS 3 WASTE DISPOSAL SITE LOCATIONS

Class 4 Sites

A Class 4 site is one which has been properly closed or is being properly operated according to provincial standards. However, continued management is required to maintain the current conditions. In total, 36 disposal sites evaluated were assigned a Class 4 rating. This total represents 22% of the 167 sites studied. Table 5-4 lists the Class 4 sites and Figure 5-4 locates them on a provincial map.

A review of Table 5-4 reveals 5 sites which have scored in excess of 100 priority points. Forest Lawn is the highest rated of these sites with a score of 127. The classification assessment of Class 4 for those sites which rate in excess of 100 priority point score points, signifies that factors such as engineering design, monitoring systems, past studies and site reclamation sucess have been taken into account. Although these sites may be located within towns or close to municipal water supplies, precautions are in place or testing is being done to avoid any adverse impact. Continued proper management will minimize or effectly reduce all potential impacts. Further information about these sites is available in Site Evaluation Volumes 1 - 11.

TABLE 5-4

ALBERTA CLASS 4 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
Forest Lawn	Calg/060	SW 11 & 2-24-29 W4	3	127
Fairview	MD 136/030	SW 03-82-03 W6	11	115
Youngstown	SA 3/160	SW 03-30-09 W4	5	110
Ryley	CO 9/080	NE 04-50-17 W4	8	102
Irvine	ID 1/040	SE 31/11-02 W4	2	100
Beaverlodge	CO 1/020	N 03-72-10 W6	11	99
Valleyview	ID 16/175	NW 21/70-22 W5	11	98
Kelsey	CO 22/130	SW 04-45-18 W4	6	98
Acme	MD 48/010	SE 19-29-25 W4	5	97
Blackfoot Trail	Calg/010	SW 34-23-01 W5	3	95
Smoky Lake	CO 13/030	SE 28-59-17 W4	10	94
Leduc	CO 25/110	NE 10-50-26 W4	7	93
Penhold	CO 23/150	NW 31-36-27 W4	4	90
Viking	CO 9/100	SE 30-47-12 W4	8	89
Pollockville	SA 2/121	NE 03-25-12 W4	5	88
Cardiff	MD 90/040	NW & SW 24-55-25 W4	9	87
Stony Plain	CO 31/160	SE 35-52-01 W5	7	87
Daysland	CO 29/030	SW 16-45-16 W4	6	87
Monarch	CO 26/137	SE 07-10-23 W4	2	85
Little Bow	CO 2/105	02-15-22 W4	1	85
Hughendon	MD 52/075	NE 08-41-07 W4	6	84
Plamondon	ID 18/340	NW 36-67-16 W4	9	83
Floating Stone	CO 19/065	SW 29-60-11 W4	10	82
St. Paul	CO 19/140	SE 06-58-09 W4	10	82
Mayerthorpe	CO 28/090	SE 23-57-09 W5	7	81
Strathmore	CO 16/210	NW 23-24-25 W4	5	81
Clive	CO 14/060	NW 29-40-24 W4	4	80
Hay Lakes	CO 22/115	SE 06-49-21 W4	6	75
Benalto	CO 23/010	NE 29-38-02 W5	4	75
Milo	CO 2/120	W 05-19-21 W4	1	75
Drayton Valley	CO 31/040	SE 20-49-07 W5	7	74
Spy Hill	Calg/125	26-25-02 W5	3	73
Islay	CO 24/050	NW 08-51-04 W4	8	72
Armena	CO 22/010	NW 01-48-21 W4	6	70
Pickardville	MD 92/090	SE 26-58-27 W4	9	62
Skelton Lake	CO 12/230	NE 32-64-18 W4	9	56

TOTAL NUMBER OF CLASS 4 SITES IS 36, OUT OF 167 SITES EVALUATED.

FIGURE 5-4

ALBERTA CLASS 4 WASTE DISPOSAL SITE LOCATIONS

Class 5 Sites

There were 19 Class 5 sites identified during the study. These sites represent 11% of the 167 sites studied. A Class 5 site is one which is properly closed or is being properly operated and there is no evidence of present or potential adverse impact. No further action is required at the site. Table 5-5 lists the sites in decreasing order of priority point scores. Figure 5-5 locates these sites within Alberta.

These 19 Class 5 sites are significant, in that, although they appeared on the MacLaren list of 167 priority 1 sites, they have been designated as sites where no further action is required. The following list capsulizes the findings upon which the Class 5 designation was based.

- Acadia Valley MD 34/020 - site was never used to accept town waste for disposal and has been properly reclaimed.

- C.R. Reiman SA 3/050 - site is located on a private citizens land, well away from areas which could be affected adversely. Very low concern wastes were deposited here.

- Bragg Creek MD 44/090 - area around Bragg Creek was not well developed in the 1940's and 50's and insignificant amounts of very low concern wastes were deposited.

- Airdrie MD 44/020 - waste at this site was removed by Alberta Land Reclamation Branch when it was being reclaimed and deposited into the new Airdrie site.

- Bellevue ID 5/020 - this site has been properly reclaimed and is well away from any areas which may be affected.

- Gibbons MD 90/060 - the waste was excavated from this site and deposited in the regional landfill when new sewage lagoons were constructed.

- Waskatenau CO 13/070 - this site has been properly reclaimed and is well away from any sensitive areas.

- Brooks CO 4/050 - this site was used as a dry dump only, receiving concrete and wood. No danger posed due to waste types being of low concern.

- Barrhead CO 11/170 - this site was submitted for approval to the Health officials, however, the application was turned down. No waste was ever received at this site.

- Spedden CO 13/030 - this site has been properly reclaimed and is well away from any sensitive areas.

- Bragg Creek MD 44/81 - this site is a transfer station. All wastes taken here are hauled away for disposal in a regional landfill.

- Plamondon ID 18/350 - this site has been properly reclaimed and is well away from any sensitive areas.

- Sylvan Lake CO 23/195 - this site has been properly reclaimed by Alberta Environment Land Reclamation Branch, and is well away from any sensitive areas.

- Lac La Nonne CO 11/070 - this site has been properly reclaimed and is well away from any sensitive areas.

- Hythe CO 1/130 - this site was submitted for approval to the Health officials, however, the application was turned down. No waste was ever disposed here.

- Dogpound CO 17/071 - this site is a transfer station. No waste is disposed here. All waste is taken to another site.

- Veteran SA 4/100 - this site has been properly reclaimed and is well away from any sensitive areas.

- Watts SA 2/200 - this site was only used by one residence to dispose of waste. The site has since been properly closed and is well away from any sensitive areas.

- Fairview MD 136/020 - this site was never used for waste disposal because the town could not agree on a purchase price.

Further information about these sites is available in Site Evaluation Volumes 1-11.

TABLE 5-5

ALBERTA CLASS 5 WASTE DISPOSAL SITES

Site Name	Site No.	Site Location	Evaluation Sheet in Volume	AESL Priority Point Score
Acadia Valley	MD 34/020	SW 27-25-02 W4	5	113
C.R. Reiman	SA 3/050	SW 28-28-06 W4	5	111
Bragg Creek (Old)	MD 44/090	SE 13-23-05 W5	3	102
Airdrie	MD 44/020	SE 12-27-01 W5	3	99
Bellevue	ID 5/020	NE 29-07-03 W5	1	93
Gibbons	MD 90/060	NW & NE 14-56-23 W4	9	88
Waskatenau	CO 13/0703	SW 16-59-19 W4	1	87
Brooks	CO 4/050	Blk. R. Plan No. 731260	2	87
Barrhead	CO 11/170	sw 29-59-03 W5	9	85
Spedden	CO 13/030	NE 29-59-12 W4	10	84
Bragg Creek	MD 44/081	NE 13-23-05 W5	3	82
Plamondon	ID 18/350	SW 3-68-16 W4	9	79
Sylvan Lake	CO 23/195	NW 28-38-01 W5	4	71
Lac La Nonne	CO 11/070	SE 17-57-02 W5	9	69
Hythe	CO 1/130	NE 11-73-11 W6	11	64
Dogpound	CO 17/071	SW 05-29-03 W5	3	62
Veteran	SA 4/100	NE 06-35-08 W4	5	61
Watts	SA 2/200	NE 17-31-15 W4	5	61
Fairview	MD 136/020	NE 02-82-03 W6	11	36

TOTAL NUMBER OF CLASS 5 SITES IS 19, OUT OF 167 SITES EVALUATED.

FIGURE 5-5

ALBERTA CLASS 5 WASTE DISPOSAL SITE LOCATIONS

CHAPTER 6
REMEDIAL MEASURE ALTERNATIVES AND IMPLEMENTATION

INTRODUCTION

To eliminate the potential for Alberta waste disposal sites to affect health and the environment a remedial action plan is required. The purpose of this chapter is to formulate a remedial action plan for Alberta. The bulk of the information presented in this chapter has been gleaned from the United States Environmental Protection Agency report "Handbook: Remedial Action at Waste Disposal Sites".

SELECTION OF REMEDIAL ACTIONS

Figure 6-1 illustrates the proposed implementation steps for an Alberta remedial action plan. This remedial action plan will gather data which may be used to:

- determine whether a problem exists at a site;
- define the extent of the problem;
- identify applicable remedial action options to mitigate the problem; and
- implement the preferred remedial action.

The implementation steps illustrated in Figure 6-1 are discussed in detail below.

Step 1 - Evaluate Nature and Extent of Contamination

Prior to the selection of any remedial program for an existing site, it is necessary to have a general indication of the extent of pollution. Information must be compiled on groundwater and surface water contamination, as well as soil and biota contamination. Monitoring of these various media will provide a more detailed view of the nature and extent of pollution.

FLOW CHART FOR

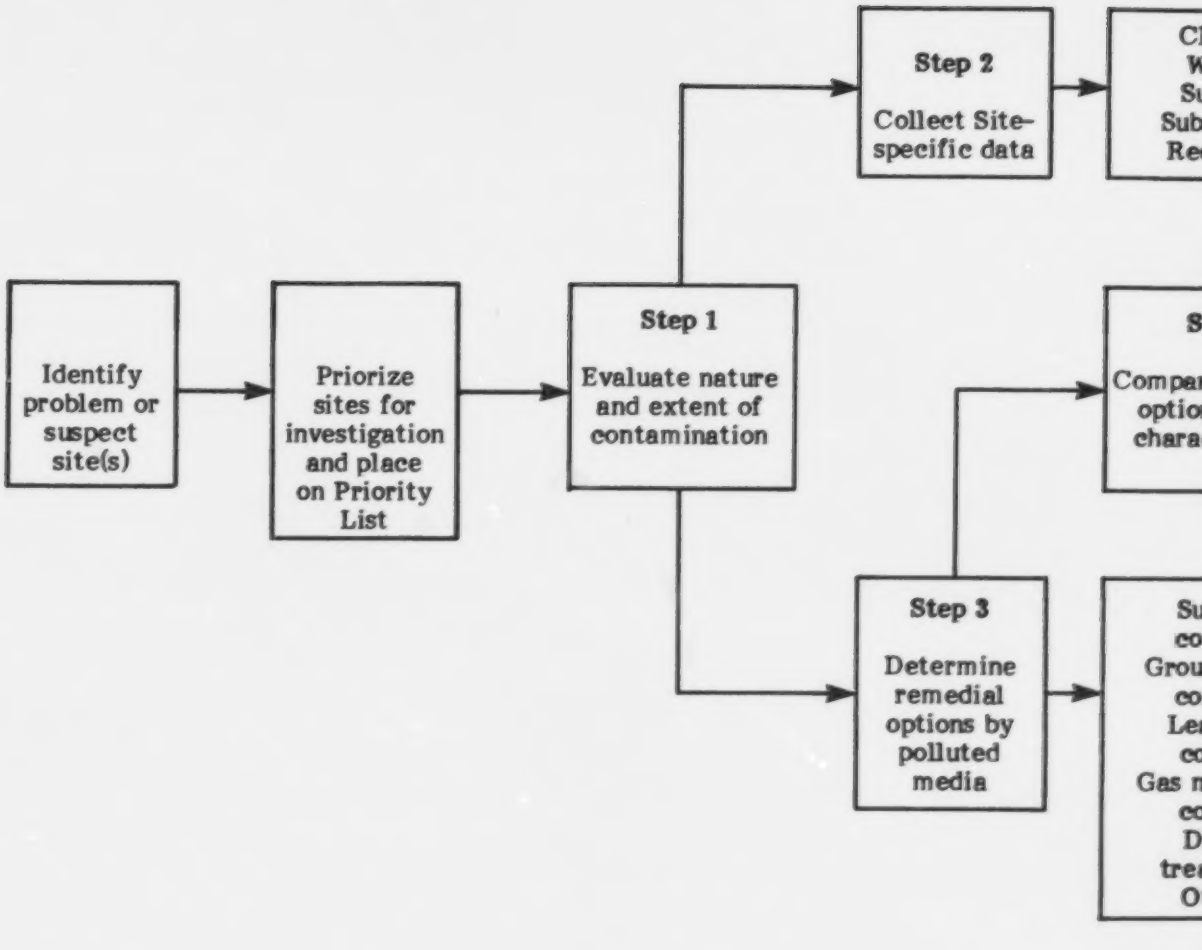
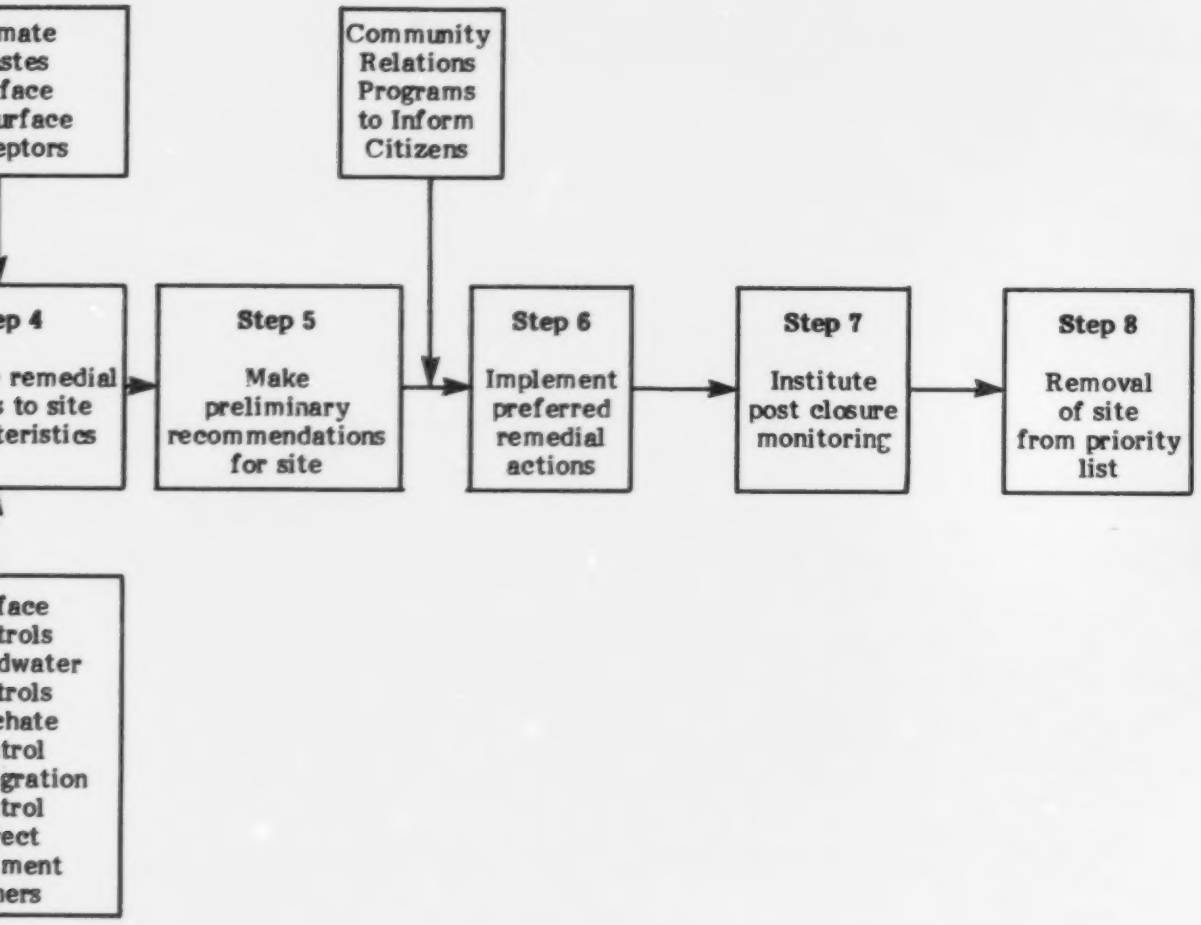

Identify problem or suspect site(s)
Priorize sites for investigation and place on Priority List
Step 1
Evaluate nature and extent of contamination
Step 2
Collect Site-specific data
Step 3
Determine remedial options by polluted media

FIGURE 6-1

MPLEMENTATION OF ALBERTA REMEDIAL ACTION STRATEGY



Groundwater sampling can take place from several sources, including:

- Wells drilled for a specific study
- Existing wells
- Springs or seeps

If wells in the area of the site are used as a source of potable water, they should be sampled to detect any pollution and to determine if a health emergency may exist. If no wells exist in the area, wells will have to be drilled and sampled. Any surface, groundwater, or leachate seep should also be sampled.

Surface water and soil samples should also be taken. The location and number of samples will depend upon the size of the site, and the amount of dumping that has taken place (if this is known).

Step 2 - Collect Site-Specific Data

Since the selection of remedial actions is highly site-specific, site characteristics are important criteria for selection of the best remedial approaches. It is best to collect as much site-specific information as early as possible in the selection process. This step may be performed concurrently with Step 3 in the flow chart (Figure 6-1). In addition to providing information on specific media, the data should include general site characteristics that may indirectly affect the choice of remedial measures.

Characteristics include quantity and quality of waste material, characteristics of site cover, the climate of the area, subsurface geology, proximity to various receptors, existing land use, and others. Table 6-1 lists important site characteristcs and the general considerations they impose on the selection of remedial actions.

TABLE 6-1
IMPORTANT SITE CHARACTERISTICS AND CONSIDERATIONS AFFECTING SELECTION OF REMEDIAL MEASURES

SITE CHARACTERISTICS	CONSIDERATIONS
Surface Characteristics	
• Soil Texture & Permeability	Coarse textured (sandy) soils have greater permeability and transmit liquid and gases faster than fine textured (clay) soils.
• Soil Moisture Content	Wet soils are less permeable to gases than dry soils.
• Slope	Steeper slopes have greater runoff, less infiltration.
	Very steep or unbroken slopes have high erosion potential.
• Vegetation	Increases infiltration, decreases erosion.
Subsurface Characteristics	
• Depths to Groundwater	Deep - Higher pumping costs.
	Shallow - May require lowering water table.
• Permeability	Permeable soils readily transmit water and gases.
	Low permeability causes difficulty in pumping; drainage.
• Depths to Bedrock	Shallow impermeable bedrock may cause leachate surface seepage; shallow or deep permeably bedrock may cause rapid and extensive contaminant migration.
	Deep - Limit on trench excavation depth.
• Direction of Groundwater Flow	Direction of flow toward point of use presents a significant impact; points of discharge must be known to assess areal extent of contamination and degree of impact.

TABLE 6-1
IMPORTANT SITE CHARACTERISTICS AND CONSIDERATIONS AFFECTING SELECTION OF REMEDIAL MEASURES

SITE CHARACTERISTICS	CONSIDERATIONS
Waste Characteristics	
• Quantity	Determines volume, size of area, affects costs.
• Chemical Make-up	Determines transport paths, materials of construction.
• Toxicity	High toxicity calls for immediate action, worker safety.
• Persistence/Biodegradability	Resists decomposition/can be treated by biodegradation.
• Radioactive	Requires special materials of construction, worker safety, site security.
• Ignitable	Explosion hazards.
• Reactivity/Corrosiveness	Requires special materials of construction, potential explosion.
• Infectiousness	Calls for immediate action, worker safety.
• Solubility	Affects hydrology migration.
• Volatility	Affects migration in gaseous state.
Climate	
• Precipitation	Humid areas - abundant surface water, shallow groundwater table. Arid areas - high wind and water erosion potential, deep groundwater table.
• Temperature	Affects physical processes such as rates of reaction, volatilization, sealed container pressure, as well as microbial degradation and transformation processes.

TABLE 6-1
IMPORTANT SITE CHARACTERISTICS AND CONSIDERATIONS AFFECTING SELECTION OF REMEDIAL MEASURES

SITE CHARACTERISTICS	CONSIDERATIONS
Receptors	Nearby working and residential populations, farms, grazing lands, natural areas, critical habitats may require immediate relief.
Existing Land Use	Maintenance of site security, protection of equipment, and soil cover from accidental abuse; vandalism.

Step 3 - Determine Remedial Options

For each environmental medium that is contaminated, a set of remedial actions exists that may be applicable to the site. These remedial options are sumarized in Table 6-2. Remedial action techniques are usually classified according to the contaminated environmental media to be remedied or controlled - - surface water, groundwater, air/soil pores, soil/sediments, waste materials, and contaminated sewer and water pipelines. The individual techniques presented in each table are those that directy or indirectly treat the contaminated medium, or that control the extent of off-site environmental contamination by controlling natural transport or migration of the medium. Each remedial action technique may be used to control contamination of several different environmental media, and therefore several of the individual techniques appear in more than one table. The table presents all available techniques applicable for the control of the indicated medium, briefly describes their medium-specific functions, indicates general site-specific applications or restrictions for the techniques.

Step 4 - Compare Remedial Options to Site Characterists and Select Best Remedial Actions

Table 6-2 can be used to compare the remedial options listed under each medium as they apply to, or are restricted by, the site characteristics information collected in Step 2. Each technique can be rated and ranked in relative order on the basis of engineering feasibility, effectiveness, and cost. In this step, certain remedial actions will be excluded because they are not feasible, while others will be identified as appropriate.

This process should result in selection of one or two remedial measures best suited for application to each specific medium. At this point, a preliminary remedial action plan for site clean-up (Step 5) can be made.

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE	FUNCTIONS	APPLICATIONS/RESTRICTIONS
CONTAMINATED SURFACE FLOWS		
• Surface Sealing/ Capping	• Isolates waste from contact with surface runoff and infiltration • Stabilizes surface of site, controls off-site transport of contaminated sediments and debris • Prevents surface leaks of leachate • Supports revegetation	• All land disposal sites • Most effective when combined with grading and revegetation • Requires suitable capping and cover materials
• Grading	• Shapes surface topography to provide for non-erosive runoff and minimize infiltration • Supports revegetation	• All land disposal sites • Most effective when combined with surface sealing with revegetation • May require special landfill equipment
• Revegetation	• Stabilizes site surface • Controls erosion by wind & water • Controls off-site transport of contaminated debris • Enhances surface sealing • May prepare site for future re-use	• All land disposal sites • Only recommended for properly sealed sites • May require irrigation in arid climates • Most effective when combined with grading • May require special construction techniques and long-term maintenance
• Surface Water Diversion and Collection Structures - Dikes and Berms - Ditches, diversions and waterways - Terraces & Benches - Chutes & Downpipes - Levees	• Upslope or at perimeter of site, channels runoff around critical areas • Downslope or onsite, controls off-site erosive transport of contaminated sediments • Collects/channels contaminated runoff to basins/traps	• All land disposal sites in sloping areas, surface impoundments • Most suited for wet climates • Often provides only short-term control for small drainage areas • Associated maintenance costs • Most effective when combined with grading and revegetation
• Seepage Basins	• Collects surface runoff from diversion and provides for recharge to groundwater	• Wherever diversion structures have been implemented and where soil permeability is not too low to allow for recharge

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE		FUNCTIONS	APPLICATIONS/RESTRICTIONS

	• Sedimentation Basins/ Traps
	  · Check dams
	  · Sedimentation basins/ponds
		• Collects and detains contaminated sediments eroded from disposal site surface
		• Sediment-laden surface runoff intercepted and channeled to these structures
		• Prevents contamination of local water-courses by disposal site
			• All land disposal sites with sediment erosion problems
			• Must be located in fairly remote areas for large sediment pond construction
			• Smaller sediment traps for basins only effective for small drainage areas

	• Leachate Control
	  · Collection
	  · Recirculation
	  · Treatment
		• Controls off-site migration of surface leachate seeps (e.g., at) base of fill) by collecting and treating or recirculating leachate	• All disposal sites with surface seepage of leachate
			• Particularly applicable to sites located on bedrock, where shallow groundwater exists, or with impermeable sublayer

	• Treatment of Contaminated Surface Waters	• Removes contaminants by physical, chemical, and/or biological treatment methods	• For contaminated surface runoff or natural water-courses that must be treated
CONTAMINATED GROUNDWATER			
	• Surface Sealing	• Indirectly controls groundwater contamination by reducing surface water infiltration (provides impermeable barrier), thereby minimizing leachate generation	• All land disposal sites • Most effective when combined with grading and revegetation • Requires suitable capping and cover materials
	• Grading	• Indirectly controls groundwater contamination by promoting surface runoff and reducing infiltration, therefore minimizing leachate generation	• All land disposal sites • Most effective when combined with surface sealing and revegetation • May require special landfill equipment
	• Revegetation	• May be used to dry surface layers of filled refuse through root uptake/evapotranspiration, reducing volume of leachate generated, and thereby indirectly controlling groundwater contamination	• This function of revegetation may be be offset by enhanced detention ilfiltration of surface runoff • Site tolerant species will be effective • May be effective at landfill sites with poorly drained surface layers and non-phytotoxic wastes near the surface

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE	FUNCTIONS	APPLICATIONS/RESTRICTIONS
• Surface Water Diversion & Collection Structures - Dikes & Berms - Ditches, diversions and waterways - Terraces & benches - Chutes & downpipes	• Upslope of sites may indirectly control groundwater contamination by intercepting and diverting surface runoff around site, reducing opportunity for runoff infiltration and minimizing leachate generation	• Structures must be upslope or at perimeter of disposal site to isolate site surface from contact with storm runoff • Most suited for wet climates • Often provide only short-term control for small drainage areas • Associated maintenance costs • Most effective when combined with grading and revegetation
• Impermeable Barriers - Grout curtain - Slurry wall - Sheet piling	• Upgradient from or around sites, diverts uncontaminated groundwater flow away from wastes • Downslope or around sites contains/collects contaminated groundwater to limit extent of aquifer pollution or protect off-site wells	• All land disposal sites and surface impoundments with groundwater contamination • Requires expensive pre-construction geotechnical evaluation, limited bedrock depths of under 20 metres. Compatibility of wastes with grouts and, to a lesser extent, slurry walls has not been fully tested. Grouts not suitable to poorly permeable soils
• Permeable Treatment Beds	• Adsorption, precipitation, or neutralization of certain groundwater contaminants downgradient of polluting disposal sites	• Applicable to any land disposal site or surface impoundment with contaminated groundwater flowing downgradient of site • Carbon adsorption very costly • Not a proven technique
• Groundwater Pumping	• Lowers water table to prevent groundwater contact with buried or impounded wastes • Lowers water table to prevent surface discharge or collects a leachate plume for delivery to treatment system	• Land disposal sites and surface impoundments that are contaminating local aquifers • Particularly useful when dealing with permeable bedrock, where impermeable barriers cannot contain vertical migration
• Bioreclamation	• Bacterial degradation/removal of petrochemical contaminants and other organics as groundwater is recycled between pump stations	• Not effective for groundwater contaminated by heavy metals, certain chlorinated organics, or other non-biodegradables • Short-term treatment only • May be very costly

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE	FUNCTIONS	APPLICATIONS/RESTRICTIONS
CONTAMINATED AIR/SOIL PORE SPACES		
• Surface Sealing	• Horizontal sealing provides impermeable barrier to upward	• All land disposal sites
• Gas Barriers	• Migration/surface escape of decomposition gases and volatiles • Vertical sealing prevents lateral movement • Layered sealing systems may channel gases to vents and treatment structures	• Layered systems most effective for control of gas migration • Vertical barriers should not be used alone for control of lateral migration • Clay may crack in arid regions
• Gas Ventilation Systems - Pipe vents - Trench vents	• Prevents lateral subsurface migration of gases • Safely vents hazardous gases to the atmosphere or to treatment structures	• Applicable as a remedial technique for control of volatile toxics or methane and decomposition gases at land disposal sites
• Gas Collection and Treatment	• For control of volatile toxics, and malodorous decomposition gases, removal or destruction of pollutants by thermal oxidation or adsorption	• All land disposal sites • Generally cost-effective
CONTAMINATED SOIL AND SEDIMENTS		
• Surface Sealing	• Controls off-site transport of contaminated surface soil by capping waste site and stabilizing cover soil • Prevents leachate seeps and subsequent contamination	• All land disposal sites • Most applicable to wet climates
• Grading and Revegetation	• Controls off-site erosion of cover soil • Binds soil particles, protects from wind and rain	• All land disposal sites • Most effective when combined with surface sealing • May be costly in arid climates

TABLE 8-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE		FUNCTIONS	APPLICATIONS/RESTRICTIONS
	• Surface Water Diversion and Collection · Diversions · Benches/terraces · Sediment traps/ basins	• Upslope of sites, diverts eroding runoff • Downslope or on site surface, slows runoff, controls soil erosion, channels sediment-laden runnoff to collection structures (traps/basins) or stabilization outlets • Traps and collects sediments	• All land disposal sites • Structures often temporary in nature • For small dainage areas • Usually combined with revegetation and grading for long-term erosion control
	• Leachate Control	• Indirectly functions to prevent soil contamination by collecting and treating leachate that might otherwise migrate off-site	• All land disposal sites and surface impoundments • Effectiveness limited in poorly permeable soils
	• Disposal of Dredged Sediments	• Safe disposal of contaminated sediments in secure landfill or by incineration	• Only cost-effective for large volumes of dredged/excavated sediments
	• Wet Excavation Techniques · Stream diversion · Mechanical excavation · Hydraulic dredging · Dewatering	• Removes contaminated sediments from streams, rivers, and wet-lands that may be ecologically fragile or important as public water sources	• For contaminated sediments that have been eroded from the site and deposited in stream beds or wet-lands • Only cost-effective for removing large volumes of sediments • Mechanical excavation is more cost-effective for small, low flow streams • May not be feasible for very remote inaccessible sites
HAZARDOUS WASTES			
	• Mechanical Excavation	• Removes waste materials from site for treatment or secured disposal by power shovel, clam-shell, etc.	• Landfills, small surface impound-ments with high-solids waste material
	• Hydraulic Dredging	• Pumps waste materials to treat-ment, or for transportation to secured disposal	• Surface impoundments with pumpable solids
	• Land Disposal	• Disposes of waste materials in impoundments, landfills, and landforms	• Most widely used method for waste disposal • Improper disposal can result in air pollution, groundwater and surface water contamination

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE	FUNCTIONS	APPLICATIONS/RESTRICTIONS
• Incineration	• Thermally oxidizes waste material in controlled environment	• Most effective for all organic wastes, especially those with low flash points and containing relatively low ash contents • Applicable to wastes that are oxidizable at temperatures below 800°C
• Wet-Air Oxidation	• Oxidizes waste material by low-temperature thermal air	• Most economical for wastes with high COD • May be used in conjunction with biological treatment
• Solidification	• Incorporates waste material into immobile matrix such as cement or resin	• Most economical for small quantities of waste. Waste material must be compatible with solidification agent. Not well demonstrated for nonradioactive wastes • May leach from some matrices over time
• Encapsulation	• Surrounds waste material with impermeable coating	• Most applicable to containerized waste materials or dewatered sludges • Not full demonstrated • Costly
• Solution Mining Technical	• Treats the wastes in-place by mobilizing contaminants or flusing them through to groundwater, and collecting	• Most applicable to surface impoundments • May eliminate need for hazardous excavation • Best suited for flushing heavy metals and basic organics • Difficult to determine extent to whienh solution makes contact with wastes • Generally used with groundwater pumping or leachate collection • Not well demonstrated
• In-situ Solidification	• Injects waste solidification agents directly into waste site	• Applicable to liquid wastes from surface impoundments, well defined landfill sections. Not applicable to containerized wastes

TABLE 6-2
SUMMARY OF REMEDIAL ACTION TECHNIQUES (AFTER U.S.E.P.A. 1982)

TECHNIQUE		FUNCTIONS	APPLICATIONS/RESTRICTIONS
	• In-situ Neutralization/Detoxification	• Neutralizes or immobilizes wastes by application of a neutralization agent such as lime to the waste material	• Most applicable to surface impoundments, disposal sites with permeable surfaces • Metal-bearing wastes. Degree of effectiveness difficult to determine
	• Microbial Seeding	• Biodegrades organic wastes	• Most effective for landfarms and surface impoundments • Can degrade a wide range of organics when acclimated • Degradation process is slow and requires adequate aeration
CONTAMINATED WATER AND SEWER LINES			
	• In-situ Cleaning · Scouring · Flushing · Dredging · Suction Cleaning	• Cleans interiors of municipal sewer and water pipelines infiltrated by contaminated sediments or groundwater • Removes infiltrated contaminants	• Most applicable to contaminated gravity sewer lines • Most techniques well established and cost-effective
	• Leak Detection and Repair · Pipeline Inspection · Grouting · Relining	• Allows discovery and repair of leaks, cracks, etc. (points of infiltration/exfiltration)	• Most applicable to contaminated sewer lines • Techniques well established and generally cost-effective
	• Pipeline Removal and Replacement	• Replaces badly damaged sewer lines or contaminated water mains	• May be only option feasible for contaminated public water mains • Very costly for deep pipelines

Step 5 - Make Preliminary Recommendations for Site Clean-Up

Because of the substantial environmental impact of polluting waste disposal sites and the large costs for site clean-up, implementability, and other factors, detailed analysis of each remedial measure, will be necessary before final recommendations can be made. However, the initial screening of alternate plans is a usefull planning tool for remedial action implementation. Problems in application of the remedial actions themselves can be brought into greater focus during development of preliminary recommendations. The preliminary plan also serves to familiarize personnel with the range of remedial action alternatives and the possible disadvantages and benefits from each. At this point, a community relations program should also be instituted. The program should:

- make contact with the community;
- hold a meeting if necessary;
- outline the site problem; and
- explain remedial measures to be implemented.

Step 6 - Implement Preferred Remedial Action

In this step, a final recommendation is made on the remedial action technique best suited for a specific site. Engineering evaluations are completed and costs estimated for a remedial action budget. The recommended remedial action is then implemented and the site made environmentally secure.

Step 7 - Institute Post Closure/Remedial Action Monitoring

At all sites which undergo remedial action, a post closure/remedial action monitoring system should be instituted. The purpose of this system would be to ensure that the actions taken at a site in fact work. The length and degree of post closure monitoring must reflect the type of actions taken and the complexity of those actions.

Step 8 - Removal of Site from Priority List

This final step in the implementation program removes the site from the Alberta waste priority list. This removal from the list should only take place when the previous seven steps have been completed and all parties are assured of the security of the site.

CHAPTER 7
RECOMMENDATIONS

This study has reviewed and rated 167 waste disposal sites, which have been identified as having the potential to affect human health, safety and the environment. While analyzing these sites, a number of recommendations to improve the Alberta quality of life through the protection of the environment has become apparent. The recommendations made as a result of this project are:

1. **To make funds, equipment, and manpower available to investigate those sites in Alberta which have been identified as Class 1 in this study.**

There are 18 sites of the 167 studied, which are Class 1 - those potentially posing a danger of causing irreversable or irreparable damage to the public health or environment. A remedial action program such as the one described in Chapter 6 should be implemented for each of these sites. The Class 1 sites should all be investigated before work is commissioned on any other disposal site evaluated in this study.

2. **To make funds, equipment, and manpower available to investigate, those sites which have been identified as Class 2, 3, and 4 in this study.**

There are 130 sites of the 167 studied, which are Class 2, 3, and 4. These sites should be evaluated in terms of the remedial action program identified in Chapter 6 at a date when all Class 1 sites have been addressed. The order in which future analysis should be undertaken is that Class 2 sites should be addressed prior to Class 3, which should be addressed prior to Class 4. All 130 sites should be investigated.

3. No further action is required for Class 5 sites identifed in this study.

The 19 Class 5 sites, have in our opinion, been properly closed, and funds would be better directed to other sites within the province.

4. A caveat on development should be placed on all waste disposal sites when they are closed.

Future development should be restricted on land that has been used for waste disposal to ensure that future uses will not produce hazards to public health or the environment. The Province should maintain permanent records of all such sites, and make the information available to local governments, the public and land purchasers. The Province should ensure restrictive permit and deed conditions to mandate long term care, monitoring and surveillance of waste disposal sites. Local governments should be required to institute strict land use controls on these sites.

5. To increase legislative and regulatory powers by the Province to ensure sufficient means to stimulate site remedial actions.

Existing provincial government power is inadequate to deal with the control of inactive sites and new laws are necessary:

- To provide a mechanism for immediate governmental response to acute problems at disposal sites;
- For long term removal or containment of wastes; and
- For ability of the province to proceed with civil actions related to waste dumps.

6. **Disposal of wastes in unsupervised disposal areas should be prohibited.**

The Alberta Government has a successful regional solid waste management assistance program, whereby numerous poorly operated and sited dumps are replaced by one properly operated regional sanitary landfill. Greater emphasis on this program, eliminate poorly operated and sited dumps, replacing them with properly operated regional sanitary landfills. This would ensure fewer surprises for future generations.

APPENDIX A

MacLaren Plansearch
Priority One Disposal Site
Information Tables

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

I.D. #1

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Suffield	ID 1/110	NE 34-14-09W4	Medicine Hat	ID1 Mun. Aff.	A	2	130	- permeable soil - close to town - contact water table - adjacent to surface water
Irvine	ID 1/040	SE 31-11-02W4	Medicine Hat	Irvine (T)	A	Not Available	115	- institutional waste - permeable soil - close to town - close to wells

I.D. #5

Bellevue	ID 5/020	NE 29-07-03W5	Chinook	ID5 Mun. Aff.	I	1	117	- close to water supply - permeable soil - close to wells - open dump - adjacent to surface water
Frank	ID 5/050	SW 30-07-03W5	Chinook	ID5 Mun. Aff.	I	Not Available	115	- institutional waste - permeable soil - close to wells

I.D. # 7

Drumheller (Reg)	ID 7/010	NE & SE 36-28-20W4	Drumheller	Drumheller (C)	A	10	110	- pesticide collection site - close to town - surface water contact

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

I.D. #10

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Caroline (Old)	ID 10/030	NE 11-36-06W5	Red Deer	Caroline (V)	I	Not Available	103	- permeable soil - close to town - close to wells
Rocky Mountain House	ID 10/100	SE 19-39-07W5	Red Deer	Rocky Mtn. House (T)	A	27	101	- institutional waste - contact water table

I.D. #14

Edson	ID 14/050	NE 09-53-17W5	Alta. West Central	Edson (T)	A	Not Available	139	- institutional waste - close to town - leachate - contact water table - surface water contact
West Edson	ID 14/200	SE 29-53-17W5	Alta. West Central	ID 14 Mun. Affairs	A	40	108	- liquid wastes - permeable soil - close to town - surface water contact
Hinton	ID 14/090	NE 11-51-25W5	Alta. West Central	Hinton (T)	A	13	89 - Data Sht 96 - Report	- institutional waste - close to town - surface water contact

I.D. #16

Valleyview	ID 16/175	NW 21-70-22W5	Grande Prairie	Valleyview (T)	I	2	107- Data Sht 104- Report	- institutional waste - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

I.D. #17

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
High Prairie #2 (Old)	ID 17/200	SE 26-74-17W5	Peace River	High Prairie (T)	I	Not Available	157	- permeable soil - close to town - close to wells - surface water contamination - methane gas
High Prairie (New)	ID 17/190	NW 24-74-18W5	Peace River	High Prairie (T)	A	5	119	- institutional waste - permeable soil - close to wells

I.D. #18

Lac La Biche	ID 18/286	SW 31-66-13W4	Athabasca	Not Available	I	Not Available	120	- permeable soil - close to town - close to critical habitat
Plamondon	ID 18/340	NW 36-67-16W4	Athabasca	Plamondon (V)	A	11	109	- close to town - surface water contact
Plamondon	ID 18/350	SW 3-68-16W4	Athabasca	Plamondon (V)	I	2	101	- close to town - adj. to surface water

I.D. #19

Wanham (New)	ID 19/040	SE 10-78-03W6	Grande Prairie	Not Available	A	Not Available	104	- chemical wastes - close to town - surface water use

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

I.D. #22

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Peace River	ID 22/075	SW 06-84-21W5	Peace River	Peace River (T)	A	23	101	- liquid waste - permeable soil - close to town - adj. to surface water
Manning (Old)	ID 22/060	SW 27-91-23W5	Peace River	Manning (T)	I	5	95	- close to water supply - close to town

I.D. #23

Blumenort	ID 23/020	NE 35-107-14W5	High Level Ft. Vermilion	ID 23 Mun. Affairs	A	10	101- Data Sht 103- Report	- pest. collect. site - close to town - adj. to surface water

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

SPECIAL AREA 2

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Pollockville	SA 2/121	NE 03-25-12W4	Big Country	SA 2	I	Not Available	125	- close to water supply - close to town - permeable soil - close to wells - open dumping
Hanna	SA 2/080	NW 16-31-14W4	Big Country	Hanna (T)	A	23.0	110	- institutional waste - close to town - close to wells - adj. to surface water
Watts	SA 2/200	NE 17-31-15W4	Big Country	SA 2	I	Not Available	102	- close to water supply - close to town - open dumping

SPECIAL AREA 3

C.R. Reiman	SA 3/050	SW 28-28-06W4	Big Country	Neil Anderson	A	LT 1	102	- close to water supply - permeable soil - close to town - close to wells
Youngstown	SA 3/160	SW 03-30-09W4	Big Country	SA 3	A	Not Available	98	- close to water supply - close to town - close to wells

SPECIAL AREA 4

Veteran	SA 4/100	NE 06-35-08W4	Big Country	Veteran (V)	I	3.0	95	- close to town - close to water supply

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

CITY OF RED DEER

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Red Deer Motors	RD/007	SE 08-38-27W4	Red Deer	City of Red Deer	I	5.0	98	- permeable soil - close to town
Monfort School	RD/005	NW 20-38-27W4	Red Deer	City of Red Deer	I	5.0	97	- close to water supply - permeable soil - close to town

CITY OF LETHBRIDGE

Lethbridge	LETH/030	06-09-21W4	City of Lethbridge	City of Lethbridge	I	Not Available	88	- permeable soil - close to town

CITY OF EDMONTON

Frontier Farms	EDM/020	SE 07-53-23W4	City of Edmonton	Leduc - Strathcona	I	166.0	95	- institutional wastes - close to town - adj. to surface water

CITY OF CALGARY

Forest Lawn	CALG/060	SW 11 & 2 24-29W4	City of Calgary	City of Calgary	A	640.0	120	- hazardous wastes - permeable soil - close to town
Blackfoot Trail	CALG/010	SW 34-23-01W5	City of Calgary	City of Calgary	I	80.0	115- Data Sht 105- Report	- hazardous waste - liquid waste - close to town - leachate
Spy Hill	CALG/125	26-25-02W5	City of Calgary	City of Calgary	A	640.0	104	- liquid wastes - close to town - close to wells

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 1 - GRAND PRAIRIE

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Hythe (Old)	C01/130	NE 11-73-11W6	Grande Prairie	Hythe (V)	I	Not Available	120	- close to water supply - close to town - adjacent to surface water
Clairmont	C01/060	SW 26-72-06W6	Grande Prairie	Grande Prairie (Co)	A	3.0	105	- pesticide dumping - close to town
Grande Prairie	C01/100	E 11-71-06W6	Grand Prairie	Grande Prairie (C)	A	295.0	102	- pesticide dumping - close to town
Beaver Lodge (Old)	C01/020	N 03-72-10W6	Grande Prairie	Beaver Lodge (T)	I	10.0	101	- permeable soil - close to town - close to wells

COUNTY 2 - VULCAN

Mossleigh	C02/130	SE 30-20-24W4	Foothills	Vulcan (Co)	A	2.0	105	- pesticide dumping - close to water supply - close to town - adjacent to surface water
Milo	C02/120	W 05-19-21W4	Foothills	Milo (V)	A	1.0	100	- pesticide dumping - close to town
Vulcan	C02/170	SW 04-17-24W4	Foothills	Vulcan (T)	I	6.0	100	- pesticide collection site - close to town - close to wells
Little Bow Provincial Park	C02/105	02-15-22W4	Foothills	Alta. Parks	A	1.0	73	Not Available

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 4 - NEWELL

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Kinbrook I. Provincial Park	C04/095	19-17-14W4	Medicine Hat	Alta. Parks	I	1.0	109	Not Available
Bassano	C04/020	NE 18-21-18W4 (data sheet) NW 17-21-18W4 (report)	Medicine Hat	Bassano (T)	A - Report I - Data Sht	5.0	104	- permeable soil - close to town - surface water - contact
Bassano	C04/010	NW 17-21-18W4 (data sheet) NE 18-21-18W4 (report)	Medicine Hat	Bassano (T)	I	5.0	103	- institutional work - close to water supply - close to town
Brooks	C04/050	Blk. R. Plan No. 731260	Medicine Hat	Brooks (T)	I	8.0	89	- within town - surface water contact - water table contact

COUNTY 6 - STETTLER

Donalda (New)	C06/070	SW 05-42-18W4	Alta. East Central	Donalda (V)	A	2.0	100	- pesticide collection site - permeable soil - close to town - close to wells

COUNTY 7 - THORHILD

Radway	C07/090	SW 32-58-20W4	Sturgeon	Thorhild (V)	A	10.0	117	- close to water supply - close to town - close to wells
Thorhild	C07/110	SW 05-60-21W4	Sturgeon	Not Available	I	4.0	107	- close to water supply - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 8 - FORTY MILE

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Manyberries	C08/060	SW 24-05-06W4	Medicine Hat	Forty Mile (Co)	A	Not Available	125	- pesticide dumping - permeable soil - close to town - surface water contact - close to wells - adjacent to surface water
Bow Island	C08/010	NW 13-11-11W4	Medicine Hat	Forty Mile (Co)	A	11.0	108	- institutional waste - leachate - surface water contact
Burdett	C08/020	NW 18-10-11W4	Medicine Hat	Forty Mile (Co)	I	4.0	105	- surface water contact - close to wells - adjacent to surface water

COUNTY 9 - BEAVER

Viking	C09/100	SE 30-47-12W4	Minburn - Vermillion	Viking (T)	I	15.0	111	- institutional waste - leachate - surface water contact
Ryley (Old)	C09/080	NE 04-50-17W4	Vegreville	Ryley (V)	I	2.0	108	- permeable soil - close to town

COUNTY 10 - WETASKIWIN

Millet	C010/130	SW 33-47-24W4	Wetoka	Millet (V)	I	2.0	107	- close to town - surface water contact - site not covered
Wetaskiwin	C010/210	SE 21-46-24W4	Wetoka	Wetaskiwin (Co)	A	9.0	88	- leachate - contact water table

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 11 - BARRHEAD

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Manola (Old)	C011/090	NE 16-59-02W5	Sturgeon	Barrhead (Co)	I	5.0	138	- close to water supply - permeable soil - no cover - adjacent to surface water - close to wells
Barrhead	C011/170	SW 29-59-03W5	Sturgeon	Barrhead (Co)	A	Not Available	94	- chemical wastes - permeable soil - close to town
Lac La Nonne	C011/070	SE 17-57-02W5	Sturgeon	Barrhead (Co)	I	5.0	89 - Report 87 - Data Sht	- not rehabilitated - close to water - surface water contact

COUNTY 12 - ATHABASCA

Skelton Lake (New)	C012/230	NE 32-64-18W4	Athabasca	Athabasca (Co)	A	5.0	110	- leachate - contact water table - surface water contact

COUNTY 13 - SMOKY LAKE

Waskatenau (Old)	C013/070	SW 16-59-19W4	North Eastern Alberta	Waskatenau (V)	I	2.0	108	- close to town - close to wells
Spedden	C013/040	NE 29-59-12W4	North Eastern Alberta	Smoky Lake (Co)	I	2.0	103	Not Available
Smoky Lake (Old)	C013/030	SE 28-59-17W4	North Eastern Alberta	Smoky Lake (T)	I	Not Available	102	- permeable soil - close to water supply - close to town
Waskatenau (New)	C013/065	SE 09-59-19W4	North Eastern Alberta	Waskatenau (V)	A	2.0	100	- pest. collection site - close to town - close to wells

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 14 - LACOMBE

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Lacombe	C014/160	SE 36-40-27W4	Red Deer	Lacombe (T)	A	19.0	129	- pesticide dumping - permeable soil - close to town
Clive	C014/060	NW 29-40-24W4	Red Deer	Clive (V)	A	7.0	110	- close to towns - close to wells
Alix	C014/010	NW 29-39-23W4	Red Deer	Alix (V)	A- Report I - Data Sht	12.0	90	- permeable soil - close to town - adjacent to surface water

COUNTY 16 - WHEATLAND

Rosebud	C016/160	SW 18-27-21W4	Drumheller	Wheatland (Co)	I	0	130	- close to town - open dump - adj. to surface water - surface water contact
Strathmore	C016/210	NW 23-24-25W4	Drumheller	Wheatland (Co)	I	5.0	112	- close to town
Gleichen (New)	C016/090	SW 24-22-23W4	Drumheller	Not Available	A	1.0	106	- close to water supply - close to town - adj. to water supply
Rocky Ford	C016/140	SW 22-26-23W4	Drumheller	Rocky Ford (V)	I	1.0	103	- close to town - open dump
Standard	C016/190	SW 11-25-22W4	Drumheller	Standard (V)	I	4.0	103	- pesticide dumping - close to town - surface water contact - open dump - adjacent to surface water

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 17 - MOUNTAIN VIEW

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Olds	C017/080	SW 01-33-02W5	Mount View	Olds (T)	A	38.0	156	- institutional wastes - close to wells - close to town - contact water table - surface water contact - close to water supply - adjacent to surface water
Dog Pound	C017/070	SW 05-29-03W5	Mount View	Mountain View (Co)	I - Data Sht A - Report	1.0	133- Data Sht 115- Report	- close to towns - close to wells - adjacent to surface water
Dog Pound Transfer Station	C017/071	SW 05-29-03W5	Mount View	Mountain View (Co)	A - Data Sht I - Report	1.0	100- Data Sht 118- Report	- close to town - close to wells - open dump - adjacent to surface water
Carstairs (Old)	C017/030	SW 09-30-01W5	Mount View	Carstairs (T)	I	6.0	100	- close to town - close to wells

COUNTY 18 - PAINTEARTH

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Castor	C018/020	SW & NW 03-38-14W4	Alta. East Central	Castor (T)	A	20.0	111	- pesticide collection - close to town - surface water contact - adjacent to surface water

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 19 - ST. PAUL

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Town of St. Paul (New)	C019/140	SE 06-58-09W4	North Eastern Alberta	St Paul (T)	I	79.0	113	- close to town - permeable soil
Floating Stone	C019/065	SW 29-60-11W4	North Eastern Alberta	Alberta Parks	A	Not Available	112	Not Available
Mallaig	C019/100	Pt. N & E 24-60-10W4	North Eastern Alberta	St. Paul (Co)	A	24.0	111	- pesticide collection - close to town - surface water contact - adjacent to surface water

COUNTY 20 - STRATHCONA

Clover Bar Regional	C020/019	NW 21 & S 28-53-23W4	City of Edmonton	Edmonton (C)	A	50.00	120- Report 115- Data Sht	- institutional wastes - close to town - leachate - contact water table - surface water contact - adjacent to surface water
Ardrossan	C020/010	SE 05-53-21W4	Leduc-Strathcona	Strathcona (Co)	A	160.00	110	- liquid wates - close to town - adjacent to surface water

COUNTY 21 - TWO HILLS

Derwent	C021/020	SE 16-54-07W4	Minburn-Vermillion	Derwent (V)	A	1.0	118	- pesticide dumping - close to town - surface water contact - adj. to surface water

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 22 - CAMROSE

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Ferintosh	C022/100	NW 03-44-21W4	Alberta East Central	Ferintosh (V)	I	1.0	120	- close to water supply - close to town - leachate - close to wells
Bashaw	C022/020	SW 02-42-21W4	Alberta East Central	Bashaw (T)	A	87.0	112	- contact water table - surface water contact - adjacent to surface water - floods annually
Camrose	C022/060	NE 21-46-20W4	Alberta East Central	Camrose (C)	A	18.0	108 - Report 106 - Data Sht	- close to town - leachate - contact water table
Kelsey (Old)	C022/130	SW 04-45-18W4	Alberta East Central	Camrose (Co)	I	1.0	105 - Report 100 - Data Sht	- permeable soil - close to town - open dump - adjacent to surface water - floods annually
Bawlf	C022/030	SW 31-45-17W4	Alberta East Central	Bawlf (V)	I	10.0	100	- close to town
Hay Lakes	C022/115	SE 06-49-21W4	Alberta East Central	Shawest Farms Ltd.	I	2.0	93	- close to town - surface water contact
Rosalind	C022/180	SW 17-44-17W4	Alberta East Central	Rosalind (V)	I	15.0	92	- close to wells - permeable soil - close to town
Armena	C022/010	NW 01-48-21W4	Alberta East Central	Camrose (Co)	I	4.0	85	Not Available

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 23 - RED DEER

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Sylvan Lake	C023/195	NW 28-38-01W5	Red Deer	Not Available	I	Not Available	108	- close to town
Bowden (Old)	C023/030	SE 23 or NE 14-34-01W5	Red Deer	Birch (T)	I	Not Available	107	- permeable soil - close to town - surface water contact - open dump
Red Deer Sewage Lagoon Site	C023/177	NW 34-38-27W4	Red Deer	Red Deer (C)	I	Not Available	107	- liquid waste - permeable soil - close to town
Innisfail	C023/090	SW 29-35-28W4	Red Deer	Innisfail (T)	A	6	104	Not Available
Penhold	C023/150	NW 31-36-27W4	Red Deer	Penhold (V)	I	4	97	- close to water supply - close to town
Red Deer	C023/176	SE 28-38-27W4	Red Deer	Red Deer (C)	I	Not Available	95	- permeable soil - close to town
Red Deer Regional Landfill	C023/175	NE 33-37-27W4	Red Deer	Not Available	A	Not Available	95	- pesticide collection site - leachate - contact water table
Benalto	C023/010	NE 29-38-02W5	Red Deer	Red Deer (Co)	A	1.0	89	- pesticide collection site - close to water supply - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 24 - VERMILION RIVER

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Paradise Valley	C024/120	NW 07-47-02W4	Minburn - Vermilion	Paradise Valley (V)	A	3.0	140	- chemical & spray cans - close to town - contact water table - surface water contamination - close to wells - adjacent to surface water
Blackfoot	C024/010	NE 01-50-02W4	Minburn - Vermilion	Blackfoot (H)	A	3.0	135	- close to town - contact water table - surface water contact - close to wells
Marwayne (Old)	C024/100	NE 26-52-03W4	Minburn - Vermilion	Marwayne (V)	I	3.0	110	- close to water supply - close to town
Islay	C024/050	NW 08-51-04W4	Minburn - Vermilion	Islay (H)	A	2.0	105	- pesticide collection site - close to town - close to wells
Clandonald	C024/020	SE 17-53-05W4	Minburn - Vermilion	Vermilion River (Co)	A	2.0	102	- pesticide dumping - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 25 - LEDUC

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Calmar	C025/050	NE 25-49-27W4	Leduc - Strathcona	Calmar (T)	I	2.0	148	- close to water supply - close to town - water table contact - site is setting
New Sarepta	C025/170	NW 34-49-22W4	Leduc - Strathcona	Leduc (Co)	A	6.0	132	- close to water supply - close to town - surface water contact - adjacent to surface water
Warburg	C025/240	NE 26-48-03W5	Leduc - Strathcona	Warburg (V)	A	7.0	122	- close to water supply - close to town - contact water table - surface water contact
Leduc Regional Sanitary Landfill (Old)	C025/110	NE 10-50-26W4	Leduc - Strathcona	Leduc (Co)	I	10.0	103 - Report 98 - Data Sht	- institutional waste - leachate - water table contact - close to wells

COUNTY 26 - LETHBRIDGE

Animal Diseases Research Institute	C026/010	NE 12-09-22W4	Barons - Eureka	Agriculture Canada	I	5.0	115	- permeable soil - leachate - contact water table - surface water contact
Scabbie Butte	C026/150	NW 17-11-22W4	Barons - Eureka	Not Available	I	20.0	101	- pest. collection site - leachate - water table contact - not reclaimed
Monarch	C026/137	SE 07-10-23W4	Barons - Eureka	Not Available	I	2.0	100	- close to town - contact water table

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 27 - MINBURN

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Innisfree	C027/010	NE 03-51-11W4	Minburn - Vermilion	Innisfree (V)	A	5.0	115	- pesticide collection - close to water supply - close to town - contact water table
Manville (New)	C027/030	SW 25-50-09W4	Minburn - Vermilion	Not Available	A	93.0	122- Report 112- Data Sht	- pesticide collection site - close to water supply - close to town - close to wells
Manville (Old)	C027/040	NE 25-50-09W4	Minburn - Vermilion	Manville (V)	I	2.0	105	- permeable soil - close to town
Minburn	C027/050	SW 14-50-10W4	Minburn - Vermilion	Minburn (V)	A	2.0	105- Report 100- Data Sht	- permeable soil - close to town

COUNTY 28 - LAC STE. ANNE

Alberta Beach	C028/010	River L-17 Pt. 6045AD SW 16 & 17-54-03W5	Stony Plain - Ste. Anne	Alberta Beach (SV)	A	88.0	137	- pesticide dumping - permeable soil - close to town - leachate - contact water table - surface water contact - adj. to surface water
Gunn	C028/070	SE 10-55-03W5	Stony Plain - Ste. Anne	Lac Ste. Anne (Co)	A	2.0	102	- permeable soil - close to town - leachate - surface water contact
Mayorthorpe (New)	C028/090	SE 23-57-09W5	Stony Plain - Ste. Anne	Mayorthorpe (T)	A	32.0	96	- institutional waste - leachate - surface water contact

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

COUNTY 29 - FLAGSTAFF

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Forestburg	C029/50	NW 34-41-15W4	Alberta East Central	Flagstaff (V)	A- Report I- Data Sht	2.0	110	- close to town - contact water table - surface water contact - adjacent to surface water
Daysland	C029/030	SW 16-45-16W4	Alberta East Central	Daysland (T)	I	10.0	102	- close to water supply - close to town
Hardisty (Old)	C029/080	SE 12-43-10W4	Alberta East Central	Hardisty (T)	I	2.0	87	- permeable soil - close to town - water table contact

COUNTY 30 - LAMONT

Chipman	C030/040	NE 30-54-18W4	Vegreville	Chipman (V)	I	4.0	130	- permeable soil - close to town - close to water supply

COUNTY 31 - PARKLAND

Drayton Valley	C031/040	SE 20-49-07W5	Alberta West Central	Drayton Valley (T)	A	35.0	106	- close to town - surface water contact
BACM Industries	C031/010	NE 15-53-25W4	Stony Plain - Lac Ste. Anne	Genstar Ltd.	A	20.0	98- Report 91- Data Sht	- institutional wastes - permeable soil - close to town - leachate
Stony Plain	C031/160	Lot C, Pl. 570MC SE 35-52-01W5	Stony Plain - Lac Ste. Anne	Stony Plain (T) MD 84	A	90	94	- pesticide collection site - permeable site - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT #6 - CARDSTON

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Glenwood	MD 6/040	SW 01-05-27W4	Chinook	Cardston (MD)	I	3.0	135	- close to water supply - permeable soil - pesticide collection site - close to town - surface water contact - open dump - adj. to surface water
Magrath	MD 6/100	NE 26-05-22W4	Chinook	Magrath (T)	A	10.0	117- Data Sht 112- Report	- permeable soil - contact water table - close to town
Spring Coulee	MD 6/130	SW 28-04-23W4	Chinook	Cardston (MD)	A	LT 1	112	- pesticide dumping - permeable soil - close to town - surface water contact - adj. to surface water

MUNICIPAL DISTRICT #14 - TABER

Taber	MD 14/090	SW 12-10-17W4	Barons-Eureka-Warner	Taber (T)	A	70.0	126	- institutional waste - leachate - contact water table - surface water table
Grassy Lake	MD 14/030	NW 15-10-13W4	Barons-Eureka-Warner	Grassy Lake (V)	I	3.0	102	- close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT #31 - FOOTHILLS

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
High River	MD 31/110	SW 05-19-28W4	Foothills	High River (T)	I	14.0	132	- pesticide dumping - close to town - leachate - water table contact - close to wells - adj. to surface water
Black Diamond	MD 31/020	NW & SW 16-20-02W5	Foothills	Black Diamond (T)	A	13.0	114	- pesticide collection site - permeable soil - close to town - leachate - close to wells
Okotoks	MD 31/130	NW 21-20-29W4	Foothills	Okotoks (T)	A	8.0	105	- pesticide collection - close to wells
Black Diamond	MD 31/040	SE 17-20-02W5	Foothills	Black Diamond (T)	I	2.0	104	- pesticide dumping - permeable soil - close to town - close to wells
Hartell	MD 31/090	NE 09-19-02W5	Foothills	MD 31	A	2.0	95 - Data Sht 100- Report	- permeable soil - close to town - close to wells - adj. to surface water
Blackie	MD 31/050	NE 13-19-27W4	Foothills	Blackie (V)	A	4.0	97	Not Available

MUNICIPAL DISTRICT #34 - ACADIA

Acadia Valley	MD 34/020	SW 27-25-02W4	Big Country	MD 34	I	Not Available	98	- close to water supply - close to town - permeable soil - close to wells

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT #44 - ROCKY VIEW

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Bragg Creek Transfer Station	MD 44/080	NE 13-23-05W5	Mount View	MD 44	I	4.3	137- Data Sht 129- Report	- close to water supply - close to town - pesticide containers - close to wells
Airdrie	MD 44/020	SE 12-27-01W5	Mount View	Not Available	I	2.0	129	- institutional waste - commercial waste - close to town - close to wells
Bragg Creek (Old)	ND 44/090	SE 13-23-05W5	Mount View	Not Available	I - Data Sht A - Report	Not Available	117	- close to water supply - close to town - close to wells
Cochrane	MD 44/110	SE 02-26-04W5	Mount View	Cochrane (T)	I	5.0	105	- close to town - close to wells
Bragg Creek (Trans)	MD 44/081	NE 13-23-05W5	Mount View	MD 44	A	4.3	104	- medium concern wastes - close to water supply - close to towns - close to wells
Shepard	MD 44/220 Data Sheet CALG/105 Report	SE 06-23-28W4	Mount View	MD 44	I	5.8	101	- close to town - close to wells
Beiseker	MD 44/050	SE 11-28-26W4	Mount View	Irricana (V)	I	5.2	90	- close to town

MUNICIPAL DISTRICT #47 - STARLAND

Delia Transfer Station	MD 47/020	NW 04-31-17W4	Drumheller	MD 47	A	Not Available	88	- pest. collection site - close to town - contact water table - adj. to surface water

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT #48 - KEEHILL

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Acme	MD 48/010	SE 19-29-25W4	Drumheller	Acme (V)	I	1.0	109	- pest. collection site - institutional waste - close to town - open dump
Linden	MD 48/080	SE 20-30-25W4	Drumheller	Isaac Geortz	I	4.0	101	- close to town - adj. to surface water
Three Hills	MD 48/110	SW 36-31-24W4	Drumheller	Three Hills	I	10.0	99	- close to town

MUNICIPAL DISTRICT #52 - PROVOST

Hughendon	MD 52/070	W 04-41-07W4	Alta. East Central	Ed Carson	A	2.0	118	- medium concern wastes - close to town - surface water contact - adj. to surface water
Czar	MD 52/050	SE 20-40-06W4	Alta. East Central	Czar (V)	A	10.0	102- Data Sht 107- Report	- permeable soil - close to town
Hughendon	MD 52/075	NE 08-41-07W4	Alta. East Central	Ed Carson	I	Not Available	93	- close to water supply - close to town
Provost	MD 52/115	SW 18-39-02W4	Alta. East Central	MD 52	I	17.0	90	- close to town

MUNICIPAL DISTRICT #61 - WAINWRIGHT

Wainwright	MD 61/080	NE 30-44-06W4	Minburn - Vermilion	Wainwright	A	15.0	122	- institutional waste - close to water supply - close to town - surface water contact
Edgerton	MD 61/020	NE 35-43-04W4	Minburn - Vermilion	Edgerton (V)	A	15.0	105	- pesticide dumping - permeable soil - close to town

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT # 87

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
Cold Lake	MD 87/050	SE 23-63-2W4	NE Alberta	Cold Lake (T)	A	2.0	124	- permeable soil - close to town
Fort Kent	MD 87/090	SW 30-61-04W4	NE Alberta	MD 87	I	1.0	105	- permeable soil - close to town - close to wells
Grande Centre	MD 87/110	SW 26-62-02W4	NE Alberta	Grande Centre (T)	A	143.0	100	- institutional waste - close to wells

MUNICIPAL DISTRICT #90

Cardiff	MD 90/040	NW & SW 24-55-25W4	Sturgeon	MD 90	I	5.0	126	- close to water supply - leachate - surface water contact - open dump - close to surface water
Gibbons	MD 90/060	NW & NE 14-56-23W4	Sturgeon	Gibbons (V)	I	5.0	96	- permeable soil - close to town - adj. to surface water
Double "L"	MD 90/050	SW & SE 05-56-23W4	Sturgeon	Double L Disposal Ltd.	I	5.0	91	- liquid wastes - close to town

MUNICIPAL DISTRICT #92

Clyde	MD 92/020	NW 36-59-25W4	Sturgeon	Clyde (V)	A	7.0	112	- pesticide containers - close to town - surface water contact
Pickardville	MD 92/090	SE 26-58-27W4	Sturgeon	MD 92	I	3.0	107	- pest. collection site - close to water supply

* A - Active
I - Inactive

SUMMARY OF PRIORITY ONE
ACTIVE AND INACTIVE DISPOSAL SITES IN ALBERTA

MUNICIPAL DISTRICT #130 - SMOKY RIVER

SITE NAME	SITE NUMBER	LOCATION (Sec., Twp., Rge., M)	HEALTH UNIT	OWNER	STATUS *	SIZE (Acres)	PRIORITY SCORE	PROBLEMS
McLennan (Old)	MD 130/080	NE 29-77-19W5	Peace River	McLennan	I	15.0	114	- close to water supply - institutional waste - close to town
Girouxville	MD 130/040	SE 17-78-22W5	PeaceRiver	Girouxville (V)	A	5.0	105	- pesticide collection site - close to town - surface water contact
Donnelly	MD 130/020	LSD 1 & 2 SW 12-78-21W5	Peace River	Donnelly (V)	I	4.0	100	- close to town - contact surface water - adj. to surface water
Fahler	MD 130/030	SE 04-78-21W5	Peace River	Fahler (T)	A	16.0	95	- close to town - surface water contact

MUNICIPAL DISTRICT #136 - FAIRVIEW

Fairview	MD 136/030	SW 03-82-03W6	Peace River	Fairview (T)	I	5.0	132	- close to water supply - close to town - surface water contact
Fairview (New)	MD 136/020	NE 02-82-03W6	Peace River	Fairview (T)	I	44.0	114	- close to water supply - close to town - close to wells

* A - Active
I - Inactive

MAPS NOT

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CARTES

OMISES